Roadmap

(revised edition)

Research and Community Service (RCS)

Department of Physics

Faculty of Mathematics and Natural Sciences (FMNS)

Universitas Gadjah Mada

2018 – 2027

August 2022

Preface

Praise is given to God Almighty for the publication of the *Roadmap* ***(revised edition***) of Research and Community Service (RCS) of the Department of Physics, Faculty of Mathematics and Natural Sciences (FMNS) Universitas Gadjah Mada in 2018–2027. This document is a revision and modification of the FMNS RCS roadmap document which contains the roadmap of each department within FMNS which was prepared and ratified in April 2018. Like the previous document, this document was developed based on UGM General Policy 2012-2037 and UGM Research Master Plan (RMP) 2017-2022, as well as a comprehensive study and development of the FMNS RCS roadmap and departments within FMNS in the previous period. The FMNS RCS Roadmap 2018–2027 was prepared to respond to several internal and external changes that occurred at Universitas Gadjah Mada (UGM) in general and at FMNS in particular. There are 3 things to be obtained in FMNS research activities, which are as follows: (1) Scientific publications both nationally and internationally, (2) Intellectual property, (3) Prototypes / products. In the field of Community Service there are 2 things that are the advantages of FMNS, namely Partner Schools and Partner Villages. Hopefully this document is useful for the entire academic community, including researchers, reviewers, and managers of RCS activities in the Department of Physics of FMNS. All department administrators express their highest appreciation and gratitude to all parties who have contributed to the preparation of this RCS roadmap.

Yogyakarta, August 19, 2022

Head of the Department of Physics,

Dr. Eng. Edi Suharyadi, S.Si., M.Si., M.Eng.

CHAPTER I
INTRODUCTION

Introduction

It is undeniable that human life, both individually, and in groups as a nation is increasingly influenced by global advances in science and technology. The ability to master, develop and utilize global science and technology has become an important factor that distinguishes the level of progress of a nation from other nations in the world. The globalization process that occurred in this era has resulted in a tendency to shift science and technology policies in developed countries. From the policy that originally focused on the formation of R&D capabilities towards the policy of building self-innovation capacity which is the result of the interaction between the development of R&D capabilities and the development of competitive capabilities.

Universitas Gadjah Mada (UGM) was established with a mandate to become a national institution of science, culture, and higher education that always practices and translates the Tridharma of Higher Education in various aspects of national and state life. Universitas Gadjah Mada is determined to dedicate science and technology and culture for the benefit of the nation and humanity. UGM is not only a reference for education and development of science and technology as well as changes in world culture, but also the delivery of science and technology to the community. To be able to carry out the mandate and realize this determination, it is necessary to make strategic steps and breakthroughs that become a reference for the direction of long-term UGM development and unite the vision for each stakeholder.

Research Master Plan (RMP)

Universitas Gadjah Mada's Research Master Plan (UGM RMP) provides policy direction in research management for units within UGM for a period of five years from 2017-2022. Therefore, the objectives of the preparation of UGM RMP 2017-2022 are to:

1. Strengthening research development strategy towards leadership, expediency, maturity, process perfection, and trustworthiness of UGM.
2. Focusing research on scientific development that differentiates UGM based on excellence and uniqueness of UGM to improve the benefit of the people of Indonesia and the world, especially in contributing to

science, society, and humanity, in the midst of strengthening higher education institutions and research institutions and other institutions.

3. Strengthening research systems, organizations, and governance by carrying out bureaucratic reforms to create excellent services in the field of research and strengthening innovation systems in carrying out research, increasing the trust of stakeholders, and providing facilities for lecturers and researchers as well as welfare guarantees based on a clean bureaucracy and free of corruption, collusion, and nepotism.
4. Strengthening the ethics and integrity of UGM's human resources as well as strengthening the ability to manage and contribute to research, to sustain UGM's leadership, usefulness, maturity, process perfection, and trustworthiness.
5. Strengthen and develop national and international cooperation to improve research infrastructure, reform funding, and improve the quality and infrastructure of research delivery.
6. Strengthening research information systems that are integrated with other information systems both inside and outside the university so that they become integrated, complete, and real time databases for the benefit of planning, implementing, evaluating, and developing research.
7. Develop inter-process synergy and interdisciplinary synergy beyond administrative management boundaries at the level of Faculties, Schools, Study Centers, Departments, Sections, Laboratories, or other work units and strengthen and accelerate the development of interdisciplinary cooperation in order to anticipate new fields so as to increase the benefits and support of national strategic areas, as well as increase the chances of success in obtaining new discoveries in multidisciplinary, interdisciplinary, and transdisciplinary research.

CHAPTER II
DEVELOPMENT OF RESEARCH AND COMMUNITY SERVICE
DEPARTMENT OF PHYSICS FMNS

The development of research at FMNS UGM is directed to have outputs in order to improve the reputation of both faculties and universities and provide benefits to the wider community. There are 3 things that should be produced, which are as follows:

1. Scientific publications both nationally and internationally
2. Intellectual wealth
3. Protype/Product.

Research development of departments within FMNS must be able to support UGM's leading researches. There are 10 leading UGM researches contained in the research master plan (RMP), which are as follows:

1) Food and Smart Agriculture Systems;
2) Smart Systems and Materials for New and Renewable Energy;
3) Smart Systems and Materials for the Service and Provision of Medical Devices and Medicines;
4) Clean Culture, Democracy, and Governance;
5) Socio-Economic System and National Resilience;
6) Demography, Gender, and Cultural Transformation;
7) Advanced Systems and Materials for Infrastructure, Transportation, and National Defense;
8) Smart Systems and Materials for Environment and Disaster Prevention;
9) Nanotechnology, Bioengineering, and Biological Materials-Systems Interfaces, and
10) Maritime.

In addition, research in departments within FMNS is directed to be able to adapt to the Technology Readiness Level (TRL) set by the Ministry of Research and Technology and Higher Education. As in figure 1 below:

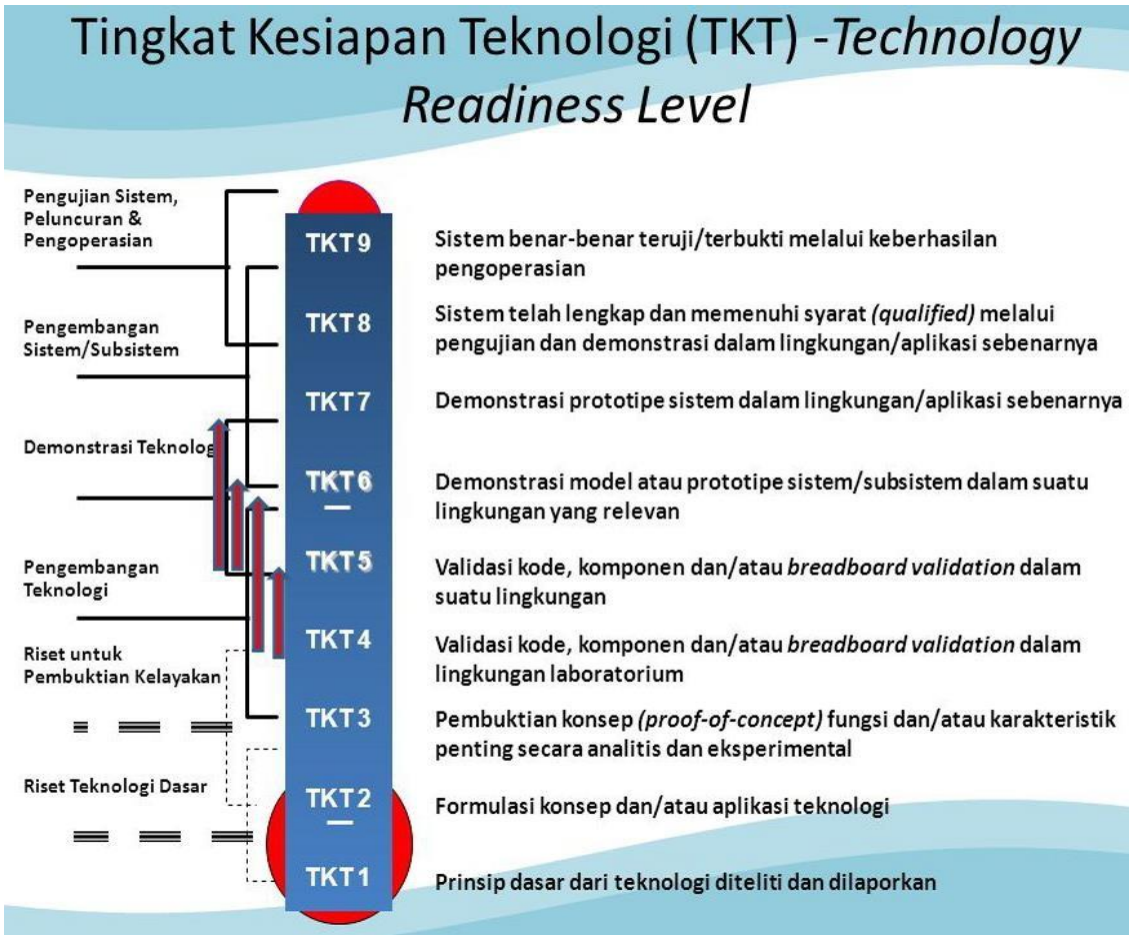


Figure 1. Technology Readiness Level

For the next 10 years (2018 – 2027), research in departments within FMNS is directed to become a Center of Excellence in *Modeling, Computational* & *Functional/Smart materials* for 4 field applications, namely:

1. Disaster &; Environment
2. Health
3. Energy Security
4. Food Security

The leading activities in the field of community service consist of:

1. Assisted Schools in the province of Yogyakarta Special Region (DIY), namely contributing from various scientific fields in FMNS to produce excellent, creative, innovative, & responsive schools to disasters and environmentally friendly.
2. Assisted Villages in the Special Region of Yogyakarta (DIY), which contribute from various scientific fields in FMNS to produce villages that are Independent, Innovative, & Disaster Response.

CHAPTER III

ILLUSTRATION OF RCS ROADMAP

The illustration and detailed structure of the research and community service roadmap (RCS) of the Department of Physics FMNS are contained in the following appendix:

UNIVERSITAS GADJAH MADA

RCS Roadmap

Department of Physics

FMIPA

2018 - 2027

April 2018

KEBIJAKAN NASIONAL KEMRISTEKDIKTI DAN UGM

Rencana Pembangunan Jangka Panjang Nasional 2005 - 2025

RPJMN I (2005 – 2009)
Menata kembali NKRI, membangun Indonesia yang aman dan damai, yang adil dan demokratis, dengan tingkat kesejahteraan yang lebih baik

RPJMN II (2010 – 2014)
Memantapkan penetapan kembali NKRI, meningkatkan kualitas SDM, membangun kemampuan Iptek, memperkuat daya saing perekonomian

RPJMN III (2015 – 2019)
Memantapkan pemb. secara menyeluruh dgn menekankan pemb. keunggulan kompetitif perekonomian yg berbasis SDA yang tersedia, SDM yang berkualitas, serta kemampuan iptek

RPJMN IV (2020 – 2024)
Mewujudkan masyarakat Indonesia yang mandiri, maju, adil dan makmur melalui percepatan pembangunan di segala bidang dengan struktur perekonomian yang kokoh berlandaskan keunggulan kompetitif.

RENSTRA DIKTI (2005 – 2009) | **RENSTRA DIKTI (2010 – 2014)** | **RENSTRA RISTEKDIKTI (2015 – 2019)** | **RENSTRA RISTEKDIKTI (2020 – 2024)**

2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024

VISI UGM 2050 → 2050

KEBIJAKAN UMUM UGM (2012 – 2037) → 2037

Pemantapan (2012-2017)

- Menjadikan etika, keilmuan, Pancasila, dan nilai-nilai ke-UGM-an sebagai dasar pendidikan dan pengajaran.
- Membangun fondasi keilmuan yg kuat utk pendidikan Sarjana.
- Mendorong keberagaman dan kemandirian dalam sistem penerimaan mahasiswa baru.
- Meningkatkan pendidikan Pascasarjana.
- Mendorong jiwa inovasi dan kewirausahaan sosial.

Pendalaman (2017-2022)

- Mengembangkan pendidikan lintas disiplin.
- Meningkatkan keberagaman dan kemandirian dalam sistem penerimaan mahasiswa baru.
- Menjadikan pendidikan Pascasarjana sebagai tulang punggung.
- Meningkatkan jiwa inovasi dan kewirausahaan sosial.
- Menguatkan dan memandirikan Sekolah Vokasi.

RIK UGM (2012 – 2037) → 2037

Renstra UGM (2008 – 2012) | **Renstra UGM (2012 – 2017)** | **Renstra UGM (2018 – 2022)**

Sinkronisasi Renstra UGM & Ristekdikti (2015-2019) | **Sinkronisasi Renstra UGM & Ristekdikti (2020-2024)**

Visi Misi UGM

VISI:
Perguruan tinggi nasional berkelas dunia yang inovatif dan unggul, mengabdi kepada kepentingan bangsa dan kemanusiaan, dijiwai nilai-nilai budaya bangsa berdasarkan Pancasila.

Misi:
1. **Mendidik bangsa Indonesia menjadi manusia susila yang cakap dan memiliki integritas berdasarkan Pancasila.**
2. **Mengembangkan ilmu pengetahuan dan kebudayaan bagi kemandirian dan kesejahteraan bangsa Indonesia.**

TUJUAN:
Menjadikan UGM sbg Perguruan Tinggi terbaik di Indonesia dengan reputasi internasional melalui:

- **Pendidikan** tinggi yang berkualitas dalam rangka menghasilkan lulusan yang unggul dan kompeten.
- **Penelitian** yang menjadi rujukan nasional yang berwawasan lingkungan, aplikatif, dan responsif terhadap permasalahan masyarakat, bangsa, dan negara.
- **Pengabdian** kepada masyarakat yang mampu mendorong kemandirian dan kesejahteraan masyarakat secara berkelanjutan.
- **Tatakelola** universitas yang berkeadilan, transparan, partisipatif, akuntabel dan terintegrasi antar bidang guna menunjang efektivitas dan efisiensi pemanfaatan sumber daya yang tangguh 0 dan berdaya guna secara berkelanjutan.
- **Kerjasama** yang strategis, sinergis, dan berkelanjutan dengan para mitra.

KEBIJAKAN UMUM UGM 2012-2037

Seluruh Aspek dan Proses di UGM Menjadi Bagian Integral Proses Akademik

PEMANTAPAN 2012-2017

- Menjadikan etika, keilmuan, Pancasila, dan nilai-nilai ke-UGM-an sebagai dasar pendidikan dan pengajaran.
- Membangun fondasi keilmuan yang kuat untuk pendidikan Sarjana.
- Mendorong keberagaman dan kemandirian dalam sistem penerimaan mahasiswa baru.
- Meningkatkan pendidikan Pascasarjana.
- Mendorong jiwa inovasi dan kewirausahaan sosial.

PENDALAMAN 2017-2022

- Mengembangkan pendidikan lintas disiplin.
- Meningkatkan keberagaman dan kemandirian dalam sistem penerimaan mahasiswa baru.
- Menjadikan pendidikan Pascasarjana sebagai tulang punggung.
- Meningkatkan jiwa inovasi dan kewirausahaan sosial.
- Menguatkan dan memandirikan Sekolah Vokasi.

PEMATANGAN 2022-2027

- Menguatkan pendidikan lintas disiplin.
- Menjaga keberagaman dan kemandirian dalam sistem penerimaan mahasiswa baru.
- Menguatkan jiwa inovasi dan kewirausahaan sosial.

PENCERAHAN 2027-2032

- Menjadi rujukan program lintas disiplin.
- Menjadi rujukan program inovatif dan kewirausahaan sosial.
- Menjadi rujukan pendidikan yang unggul dengan dasar kearifan budaya bangsa.

KEPEMIMPINAN 2032-2037

- Menjadi pemimpin perguruan tinggi berkelas dunia yang unggul dan inovatif, mengabdi kepada kepentingan bangsa dan kemanusiaan dijiwai nilai-nilai budaya bangsa berdasarkan Pancasila.

Mengembangkan fisik kampus yang mendukung interaksi antar civitas akademika

Menjadi kampus yang mendukung wahana penerapan inovasi IPTEK lintas-disiplin

Meningkatkan kampus yang mendukung pengembangan pusat unggulan yang strategis dan khas Indonesia

Mengembangkan kampus yang berwawasan lingkungan, kerakyatan, dan kebangsaan

Kebijakan Umum UGM 2012-2037
Bidang Penelitian

Pemantapan 2012-2017	Pendalaman 2017-2022	Pematangan 2022-2027	Pencerahan 2027-2032	Kepemimpinan 2032-2037
• Mengembangkan budaya penelitian lintasdisiplin untuk memperkuat kualitas pendidikan dan pengajaran. • Menetapkan prioritas penelitian strategik secara periodik. • Memperkuat sistem manajemen penelitian terpadu yang didukung pangklan data.	• Memacu inovasi ilmu pengetahuan dan teknologi yang bermanfaat bagi kepentingan bangsa, negara, dan kemanusiaan berbasis kearifan budaya. • Meningkatkan kualitas penelitian dengan melibatkan pemangku kepentingan eksternal.	• Meningkatkan akses pangkalan data penelitian, • Mewujudkan pusat unggulan yang strategis dan khas Indonesia. • Memperluas aplikasi hasil riset dengan kerjasama eksternal.	• Menjadikan UGM sebagai rujukan ilmu pengetahuan, teknologi, dan kebudayaan yang bermanfaat bagi kemnusiaan dan pembangunan bangsa. • Meningkatkan manajemen penelitian yang bertaraf internasional.	• Memimpin unggulan strategis yang khas Indonesia di kancah dunia.

- Pusat-pusat Unggulan Ilmu Pengetahuan dan Teknologi, Khas UGM
- Sains Teknopark
- Multikampus dengan *Joint Research Academy* di Asia-Afrika

- Pengembangan Intensif Pusat Inkubasi, Joint dan Corporate Laboratories
- Teaching Factory
- University Science Technopark bidang-bidang strategis lintasdisiplin

- High Tech Campus Yogyakarta sebagai Pengembangan Teaching Industry dan Corporate Laboratories
- Center For Humanity, Indigenous Knowledge, Bioethics, Pancasila and Nusantara Philosophy sebagai Pusat Rujukan Dunia

- Rujukan Dunia untuk Ilmu Pengetahuan dan Teknologi Berbasis Ke-Nusantara-an
- Rujukan Dunia untuk Global Leadership Research Academy
- Rujukan Dunia untuk Industrial Park

Kebijakan Umum UGM 2012-2037
Bidang Pengabdian kepada Masyarakat

Pemantapan 2012-2017	Pendalaman 2017-2022	Pematangan 2022-2027	Pencerahan 2027-2032	Kepemimpinan 2032-2037
• Meningkatkan pemberdayaan masyarakat dalam pembangunan berdasarkan asas manfaat dan dampaknya. • Menjadikan kampus sebagai acuan perubahan masyarakat.	• Menjadikan kampus sebagai wahana penerapan inovasi IPTEK bagi masyarakat. • Mendorong pengabdian melalui aplikasi kewirausahaan sosial. • Menerapkan sistem manajemen pengembangan produk untuk mendukung program hilirisasi penelitian.	• Menguatkan pilar pengembangan produk dan inkubasi yang mandiri. • Meningkatkan inovasi sosial dalam kegiatan pengabdian kepada masyarakat. • Membangun daya lenting (*resilience*) komunitas.	• Menjadi rujukan model pembangunan komunitas berdaya lenting (*resilience*) yang berkelanjutan. • Memiliki produk inovasi sosial dan hilirisasi penelitian berkelas dunia.	• Memimpin dalam inovasi sosialyang khas Indonesia di kancah dunia.

- Sustainable Community Empowerment Model
- Pengembangan Intensif Industri Inovasi dalam *Small Medium Size Technology* di Masyarakat oleh UGM
- Pengabdian masyarakat berbasis inovasi penelitian yang unggul dan berjangkauan internasional

- Rujukan Internasional dalam Pemberdayaan Masyarakat
- Rujukan dalam Kanal Pengetahuan bagi Masyarakat Praktisi

- Memimpin dalam inovasi pengabdian kepada masyarakat yang khas Indonesia dan berjangkauan internasional
- Pemimpin dalam Kanal Pengetahuan bagi Masyarakat Praktisi

- Kebijakan Perluasan Makna Pengabdian Telah Ditetapkan dan Diimplementasikan
- Menara Air dengan Kanal Pengetahuan untuk Masyarakat Praktisi di Seluruh Pelosok dan Penjuru Dunia
- KKN-PPM sebagai Rujukan Global RCE

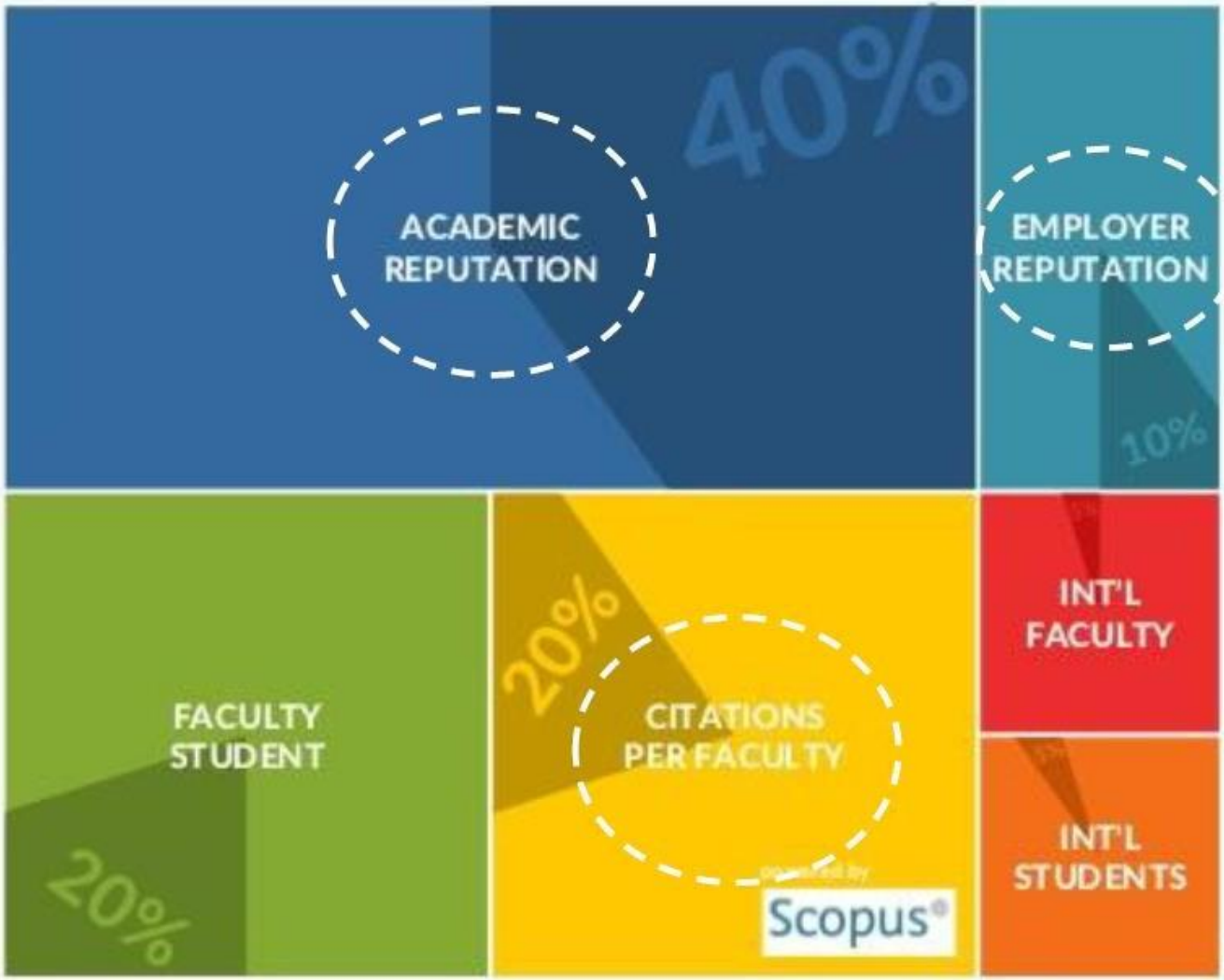
10 Leading Research UGM (in RMP)

1. Food security and security
2. New &; Renewable Energy Sources
3. Disaster &; Environment
4. Health, tropical diseases and medicine
5. Socio-culture and peace
6. Demokrasi dan good governance
7. Infrastructure
8. Intelligent System
9. Nanotechnology
10. Maritime

Increased QS- WUR Contribution

QS WORLD UNIVERSITY RANKINGS

- Consistent, simple methodology
- Stable results
- Discipline independent
- Language independent
- Low dependence on self-reporting



http://www.slideshare.net/BenSowter/qs-world-university-rankings-20152016

Policy Direction and Research Roadmap of FMNS

Three FMIPA Research Indicators

- International publications
- Intellectual Wealth
- Prototype/Product

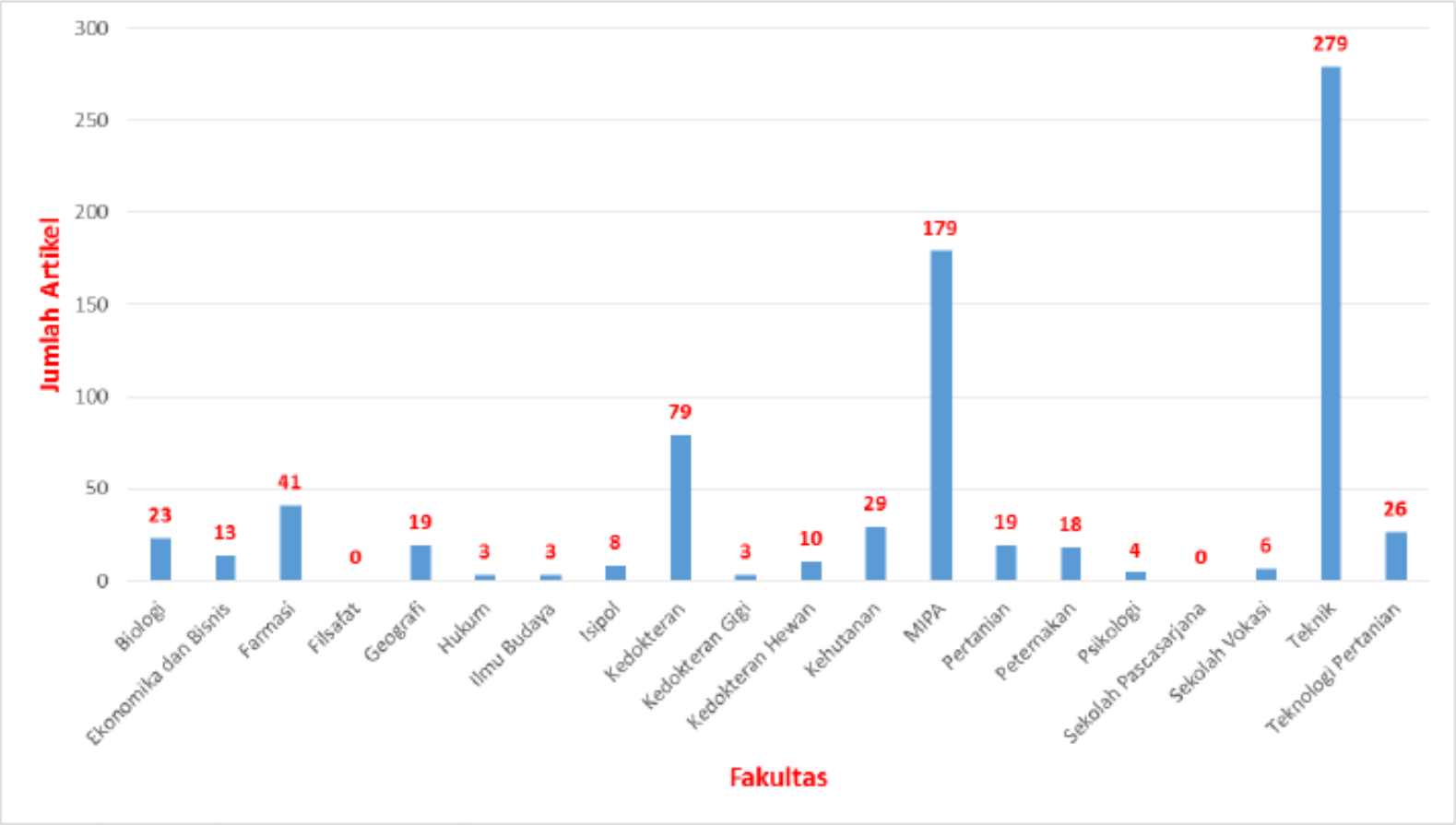
Strengths FMIPA

10 Title ranking & research funding for fiscal year 2017

No	Unit Kerja	∑ Judul
1	Fakultas MIPA	68
2	Fakultas Teknik	57
3	Fakultas Pertanian	28
4	Fakultas Farmasi	27
5	Fakultas Pertanian	24
6	Fakultas Kehutanan	21
7	Fakultas Kedokteran	19
8	Fakultas Teknologi Pertanian	18
9	Fakultas Geografi	16
10	Fakultas Kedokteran Hewan	16

No	Unit Kerja	∑ Dana (M)
1	Fakultas MIPA	11,4
2	Fakultas Teknik	10,7
3	Fakultas Farmasi	6,1
4	Fakultas Kehutanan	3,6
5	Fakultas Pertanian	3,5
6	LPPT	3,4
7	Fakultas Peternakan	3,2
8	Fakultas Teknologi Pertanian	2,9
9	Fakultas Kedokteran	2,8
10	Fakultas Geografi	2,2

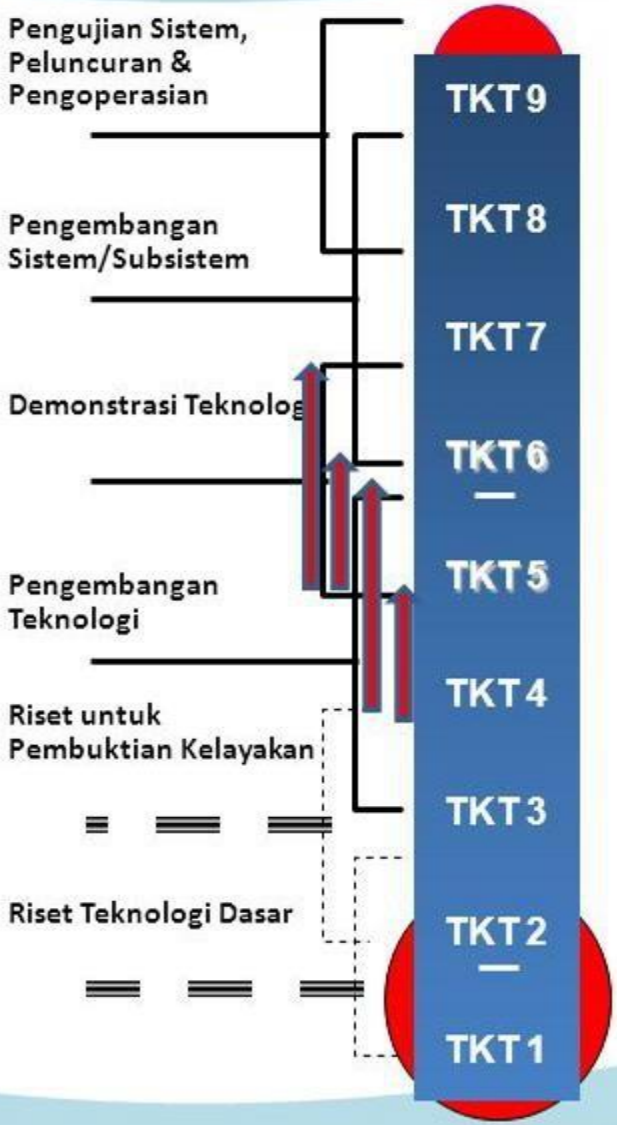
Publikasi UGM Terindeks Scopus per Fakultas



Total Jumlah Publikasi Terindeks Scopus= 810
(Data per 25 September 2017)

FMNS research is directed to be able to adapt to
Technology Readiness Level (TRL)

Tingkat Kesiapan Teknologi (TKT) -*Technology Readiness Level*



TKT 9 — Sistem benar-benar teruji/terbukti melalui keberhasilan pengoperasian

TKT 8 — Sistem telah lengkap dan memenuhi syarat *(qualified)* melalui pengujian dan demonstrasi dalam lingkungan/aplikasi sebenarnya

TKT 7 — Demonstrasi prototipe sistem dalam lingkungan/aplikasi sebenarnya

TKT 6 — Demonstrasi model atau prototipe sistem/subsistem dalam suatu lingkungan yang relevan

TKT 5 — Validasi kode, komponen dan/atau *breadboard validation* dalam suatu lingkungan

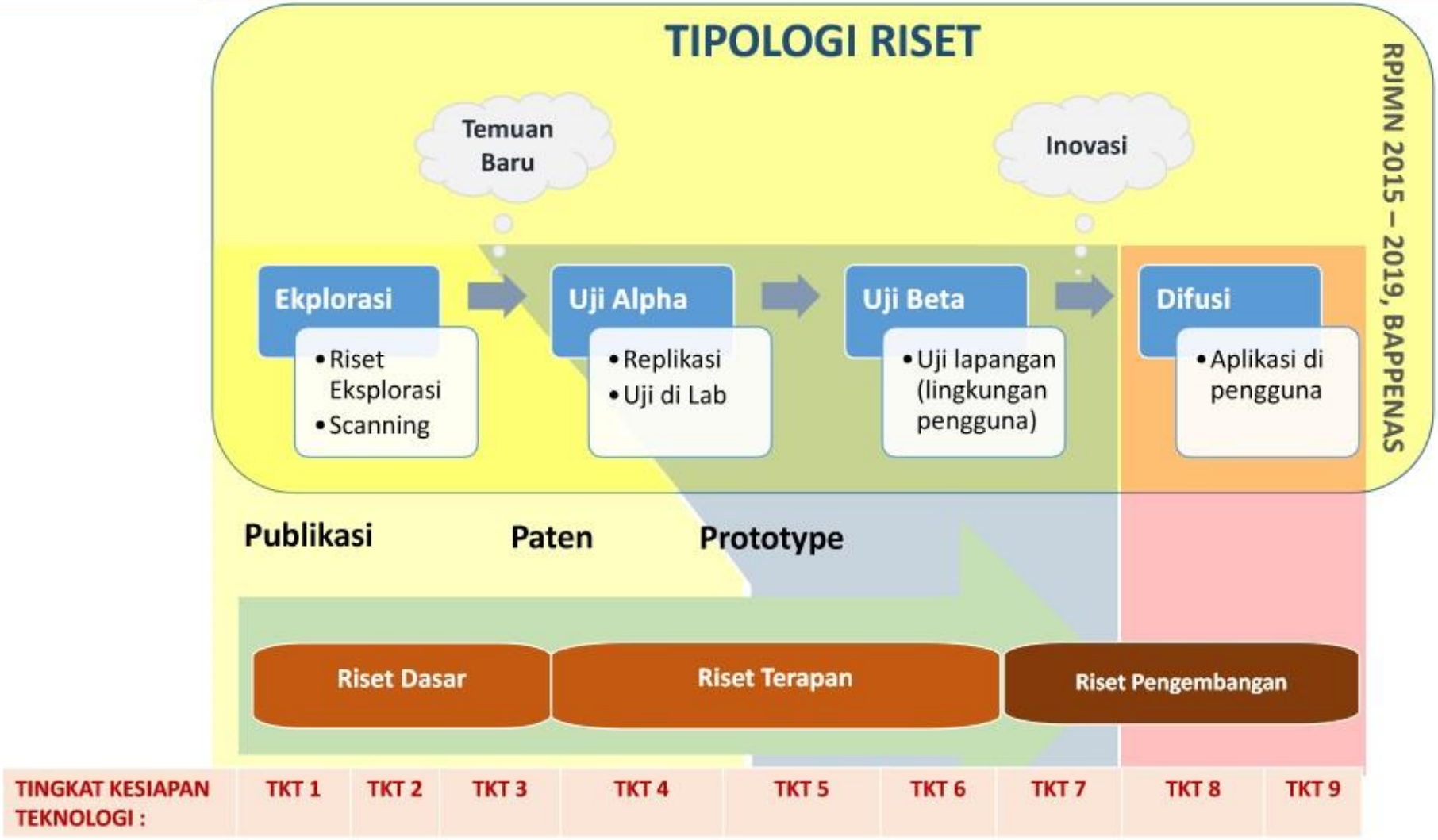
TKT 4 — Validasi kode, komponen dan/atau *breadboard validation* dalam lingkungan laboratorium

TKT 3 — Pembuktian konsep *(proof-of-concept)* fungsi dan/atau karakteristik penting secara analitis dan eksperimental

TKT 2 — Formulasi konsep dan/atau aplikasi teknologi

TKT 1 — Prinsip dasar dari teknologi diteliti dan dilaporkan

Peningkatan Kapasitas Inovasi dan Teknologi



SOCIETY 5.0

Browse

- *8 billions people bring consequences to basic needs delivery.*

Climate

- *Climate crisis -in term of global warming (climate change) has become a true planet emergency*

Life

- *A new way of life is needed*

Technology

- *Development of ICT & IOT as the next wave in global economics*

The World in 2040

Maping Research Focus of each Faculty

FAKULTAS	FOKUS RISET
1. Biologi	Bioteknologi, Biodiversity
2. Ekonomika & Bisnis	Ekonomi Kerakyatan
3. Farmasi	Herbal, Medicine
4. Filsafat	Filsafat Nusantara, Pancasila
5. Geografi	Lingkungan dan Bencana
6. Hukum	Korupsi
7. Ilmu Budaya	Budaya Nusantara
8. ISIPOL	Demokrasi
9. Kedokteran	Healthy Life

FAKULTAS	FOKUS RISET
10.Kedokteran Gigi	Dental Tissue Enginering
11.Kedokteran Hewan	Ecohealth
12.Kehutanan	Integrated Farming
13.MIPA	Nano Material IoT
14.Pertanian	Pangan, Kemaritiman
15.Peternakan	Pangan (produk hewan)
16.Psikologi	Mental Health
17.Teknik	Teknologi Energi, Infrastruktur
18.Teknologi Pertanian	Pangan (inovasi olahan)

FMIPA Research Roadmap 2018 – 2027 (10 years)

Center of Excellence in *Modeling, Computational &; Functional/Smart materials* for 4 applications:

1. Disaster &; Environment
2. Health
3. Energy Security
4. Food Security

SWOT Analysis?

1. ***Strengths*:** Already have a track record of research in fields related to Disaster &; Environment, Food Security, Energy Security, and Health. Very strong human resources. Networking that has been built with various agencies both from within and outside the country.

SWOT Analysis?

2. **Weaknesses**: Coordination of collaboration among field department staff is still weak. Limited instruments and lack of databases. Sustainability and continuity of research.

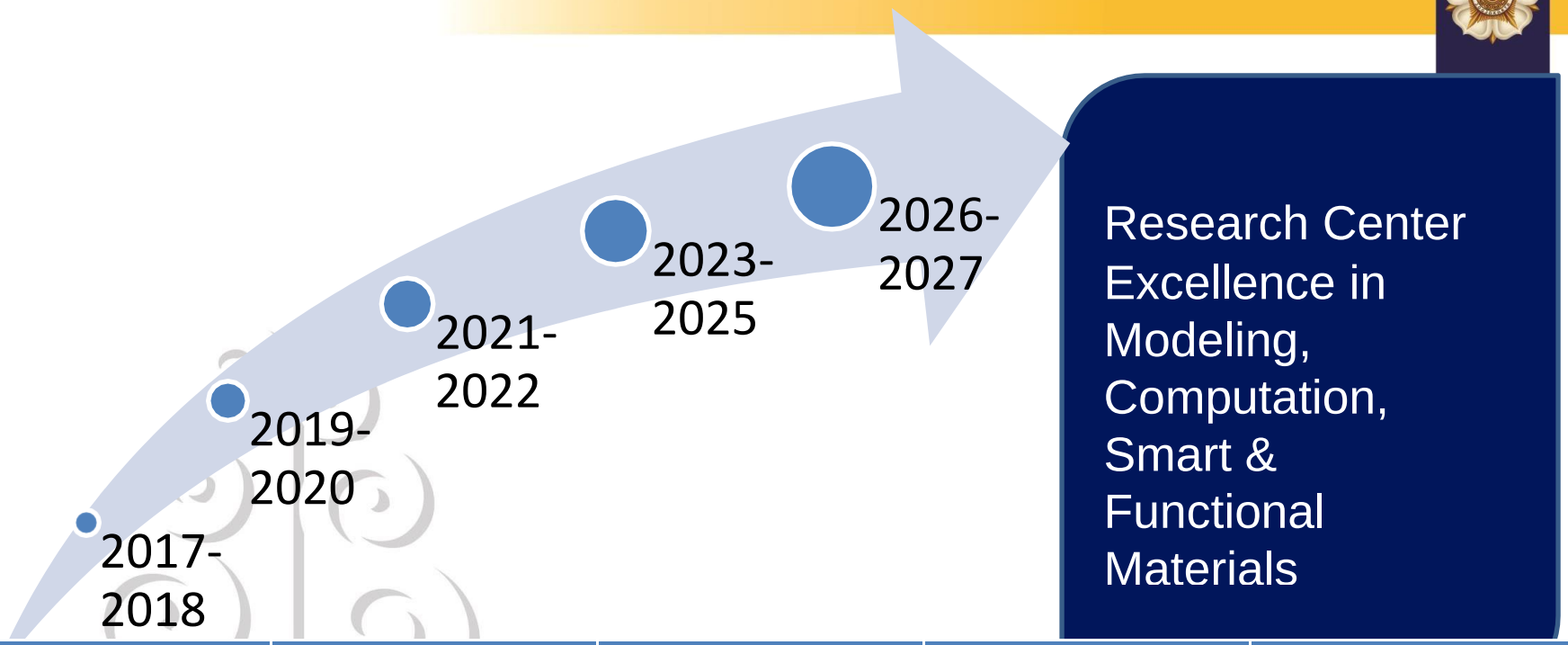
SWOT Analysis?

3. **Opportunities:** The availability of many research grants both from within the country and abroad. The opening of cooperation with industry and institutions both from within and outside the country. The diversity of research topics in FMIPA that has not been unified.

SWOT Analysis?

4. **Threats**: The emergence of various study centers that specialize in these areas of excellence in sharing agencies. The rapid development of cheap and applicable industrial products. Declining enthusiasm for research due to the burden of teaching and the complexity of research financial administration.

Modeling, computing, intelligent materials and functional materials for 4 leading areas



2017-2018	2019-2020	2021-2022	2023-2025	2026-2027
Modeling: Reviewing existing models, functional materials Publication + IPR	Modeling: Developing existing models (lab scale), functional materials Publication + IPR	Modeling: Developing existing models, functional materials (pilot scale) Publication + IPR + Protype/Product	Modeling: Simulating and analyzing/validating models, functional materials Publication + IPR + Protype/Product	Modeling: Applying the acquired model, functional materials Publication + IPR + Protype/Product

Modeling, Computing, Smart Materials and Functional Materials for 4 featured fields

Targets

2017-2018	2019-2020	2021-2022	2023-2025	2026-2027
Computing: Surveilance. Big Data Modeling in Field 4 Featured Fields Smart Materials and functional materials Research publications	Computing: Surveilance. Modeling Build infrastructure that can process data in 4 leading fields on a large scale. Publication research	Computing: Surveilance. Modeling Integrates data and infrastructure for survielence needs in 4 leading areas. Research publications	Computing: Surveilance. Modeling Analytical data observation (modeling) for prediction, data simulation, optimization, in 4 leading areas Publication research	Computing: Surveilance. Modeling Provides scientific references Research publications

Modeling, Computing, Smart Materials and Functional Materials for 4 featured fields

Targets

2017-2018	2019-2020	2021-2022	2023-2025	2026-2027
Smart Materials and functional materials Development of intelligent and functional materials: fertilizers, solar cells, absorbents, photo catalysts and membranes. (Lab Scale) Research publications	Smart Materials and functional materials Development of intelligent material 0and functional Material-based alam (Lab Scale) Research publications and IPR	Smart materials and functional materials Intelligent and functional materials test for environmental pollution remediation (lab scale) Research publications and IPR	Smart Materials and functional materials Research publications, IPR, and products	Smart Materials and functional materials Intelligent and functional material fabrication. Publication of research, IPR, products, and studies for the market

Modeling, Computing, Smart Materials and Functional Materials for 4 featured fields

	2017-2022	2023-2025	2026-2027
Strategy	FMIPA provides and completes facilities / Minimum basic instruments that must be possessed for research in 4 leading fields Attracting research funds through community funding schemes (FMIPA), decentralization and national competition, from government institutions or abroad. Increasing cooperation networks with external partners to be able to utilize research/instrument facilities that do not exist at UGM	Protitype scale promotion	Product promotion

Department of Physics

Study Program

S1 Physics Study Program (BAN-PT/A)
S1 Geophysics Study Program (BAN-PT/A)
S2 Physics Study Program (BAN-PT/Unggul)
S3 Physics Study Program (BAN-PT/A)

Laboratory

Basic Physics Lab
Atomic and Core Physics Lab
Material Physics and Instrumentation Lab
Geophysics Lab

Group of Expertise (KBK)

KBK Functional Material Physics
KBK Theoretical and Computational Physics KBK Applied Physics
KBK Geosains

Human resources

Dosen: 54

GB: 7, LK: 15, Lektor: 18, Others: 14

S3: 41 & S2:13

Tenaga Kependidikan: 22

as of August 2021

Student body

592

S1-Physics: 264
S1-Geophysics: 214
S2-Physics: 80
S3-Physics: 34

as of August 2021

Research

Number of Titles/Grants

	2021	2020	2019	2018
FMNS	106	102	104	98
DF	21 (22%)	16 (15%)	25 (24%)	22 (22%)

International publications

	2020	2019	2018
FMNS Publications	442	439	407
DF Publications	115	106	94

Student body

592

Physics (undergraduate): 264
Geophysics (undergraduate): 214
Physics (MS): 80
Physics (Doctor): 34

August 2021

Divisions:

- ✓Theoretical & Computational Physics
- ✓Applied Physics (Laser & Application)
- ✓Functional Material
- ✓Geoscience

- **Associate Professor**
  - Arief Hermanto, (Dr. Universitas Gadjah Mada, Indonesia).
  - Pekik Nurwantoro (Ph.D. Univ. of Birmingham, United Kingdom).
  - Farchani Rosyid, (Dr. rer.nat. T.U. Clausthal, Germany).
  - Rinto Anugraha NQZ,(Dr.Eng. Kyushu University, Japan).
  - Fahrudin Nugroho,S.Si.,M.Si (Dr.Eng. Kyushu University, Japan)
  - Sholihun,(Ph.D. Kanazawa University, Japan).
- **Assistant Professor**
  - Yosef Robertus Utomo.S.U (Dr. Universitas Gadjah Mada, Indonesia).
  - Eko Sulistyo.,(Dr. Universitas Gadjah Mada, Indonesia).
  - Dwi Satya Palupi, (Dr. Universitas Gadjah Mada, Indonesia).
  - Mirza Satriawan,(Ph.D. Univ. of Illinois at Chicago, United States).
  - Iman Santosa, (Dr. University of Amsterdam, Netherland).
  - Romy Hanang Setya Budhi, (Ph.D. Kanazawa University, Japan)
- **Instructor**
  - Dra.Eko Tri Sulistyani,M.Sc
  - Elida Lailia Istiqomah,S.Si.,M.Sc
  - Chalis Setyadi,S.Si.,M.Sc
  - Idham Syah Alam, (Ph.D. Kanazawa University, Japan).

Study of complex, multi-body and strongly correlated systems using numerical-based high-performance computing

2D materials: Computationa and fundamental study of optical, electronic, and thermal properties

Photon, neutron and particle simulation: medical physics, cyclotron etc

The study of opinion dynamics models in Sosiophysics

Econopysic: financial markets

Theoretical and Computational method

Teleparallel gravity and gravitoelectromagnetism: on the equivalence between teleparallel gravity and Einstein gravity, etc

The general relativistic diffusion processes in cosmology and astrophysics

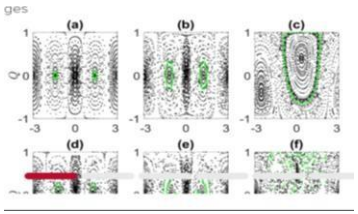
Modified gravity models on the Planck energy scale that interact non-minimally with matter

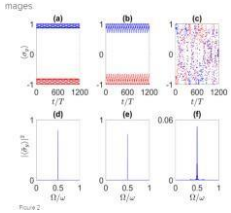
Beyond standart model : left-right symmetry model, see-saw model for neutrino mass, etc

- Fullerence and Drug-molecules Interaction: Drug Delivery Application
- Phonon Simulation of Defective Semiconductor Materials
- Carbon/Silicon/Germanium Nanoring: Stability Study Using DFT Simulation

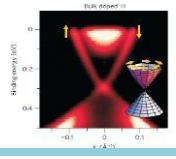
Pekik Nurwantoro,M.S., Ph.D

Study of complex, multi-body and strongly correlated systems using numerical-based high-performance computing

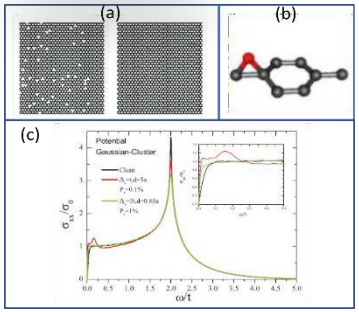




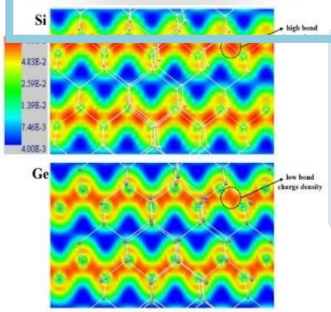
Dr.Eng.Fahrudin Nugraha,S.Si.,M.Si



Computational and fundamental study of optical, electronic, and thermal properties in two-dimensional materials



Dr.Iman Santosa,S.Si.,M.Sc

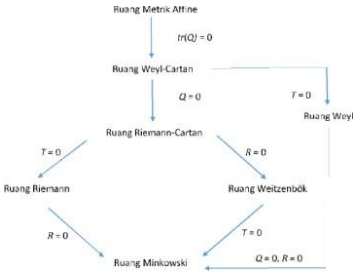


- Fullerence and Drug-molecules Interaction: Drug Delivery Application
- Phonon Simulation of Defective Semiconductor Materials
- Carbon/Silicon/Germanium Nanoring: Stability Study Using DFT Simulation

Sholihun, S.Si., M.Sc., Ph.D.Sc.

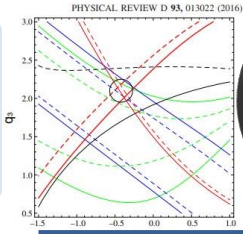
- <u>Teleparallel gravity and gravitoelectromagnetism:</u> on the equivalence between teleparallel gravity and Einstein gravity, the formulation of Friedmann equation in teleparallel gravity
- <u>The general relativistic diffusion processes in cosmology and astrophysics</u>

Dr.rer.nat.M.Farchani Rosyid,M.Si



Gambar 2.1: Klasifikasi ruang

$$\begin{tikzcd} S^3 \arrow[d, "\star"] & & \\ S^3 \arrow[r, "\bullet"] & \mathrm{Sp}(2,\mathbb{H}) \arrow[r] \arrow[d] & S^7_s \\ & \Sigma^7 & \end{tikzcd}$$

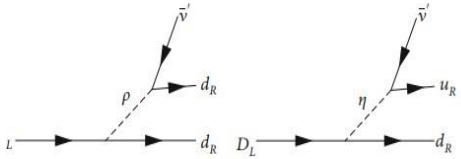


Cosmology and Modied gravity sector :

- Inflation and dynamics of F(R) modified gravity,
- Constraining F(R) gravity, Constraining F(R) gravity,
- Non-minimally coupling to the F(R) gravity,

Romy Hanang Setya Budhi, M.Sc.,Ph.D

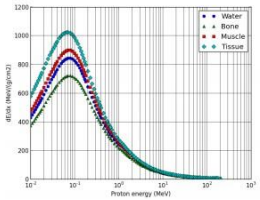
Dr.Arief Hermanto,S.U.,M.Sc



Beyond standart model :

- left-right symmetry model,
- see-saw model for neutrino mass, etc

Mirza Satriawan,M.Si.,Ph.D



Dr.Eko Sulistyo.,M.Si

Photon, neutron and particle simulation: medical physics , cyclotron etc

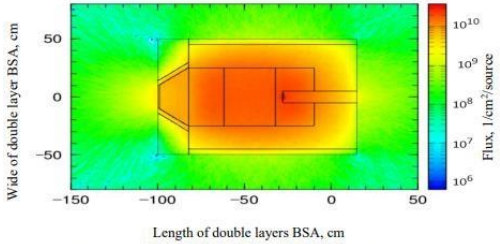
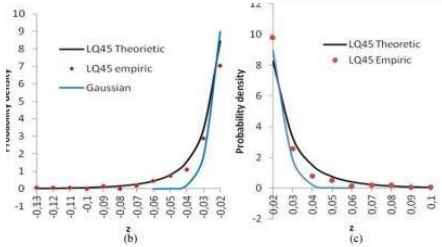
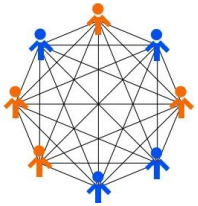


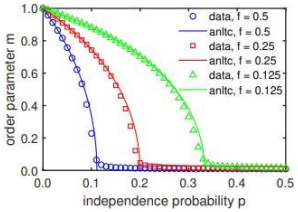
Fig. 4. Distribution of epithermal neutron flux in DLBSA
(See color Figure on the journal website.)

Dr. Dwi Satya Palupi, M.Si



Econophysics: physics for financial market





The study of opinion dynamics models in Sosiophysics

Dr.Eng.Rinto Anugraha NQZ,,M.Si

Applied Physics Division

Professor

- Agung Bambang Setio Utomo (Dr. UC Swansea, United Kingdom).
- Gede Bayu Suparta (Dr. Univ of Melbourne, Australia).

Associate Professor

- Mitrayana (Dr. Universitas Gadjah Mada, Indonesia).
- Moh. Ali Joko Wasono (Dr. Universitas Gadjah Mada, Indonesia).
- Bambang Murdoko (Dr. Universitas Gadjah Mada, Indonesia).

Assistant Professor

- Ikhsan Setiawan
- Yosef R. Utomo (Dr. Universitas Gadjah Mada, Indonesia)

Laser and Acoustics Research Group

Member of Research Group:

1. Prof. Dr. Agung Bambang Setio Utomo

2. Dr Moh. Ali Joko Wasono

3. Dr. Mitrayana

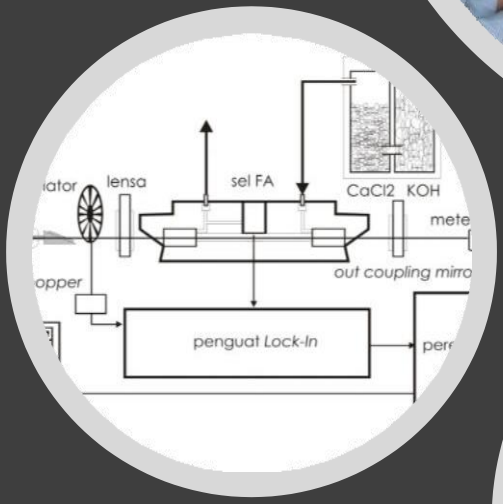
4. Dr. Ikhsan

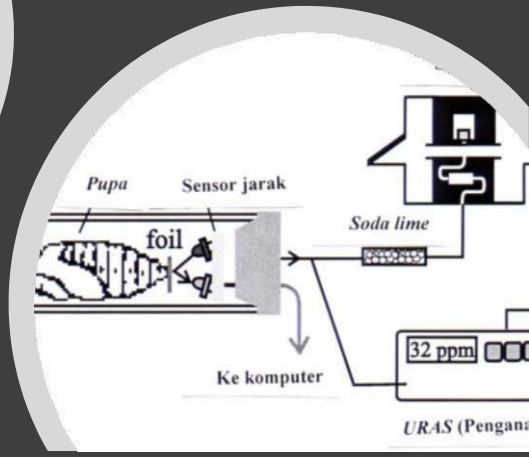
Setiawan Research

Interest :

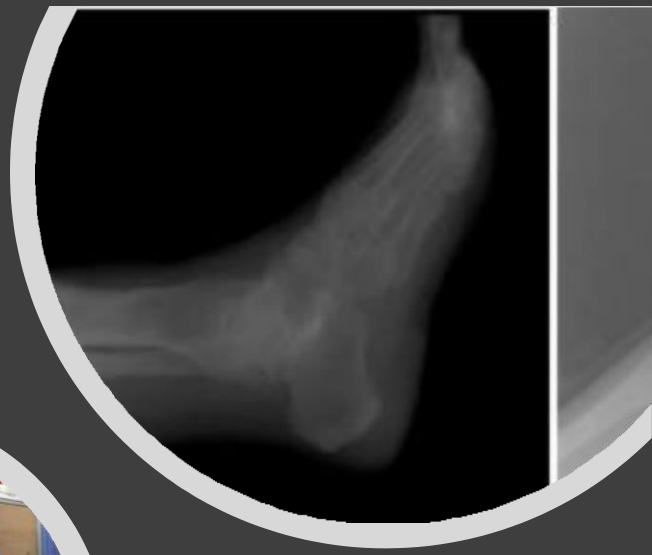
Laser Spectroscopy, Thermoacoustic, Laser-based photoacoustic spectroscopy , Photoacoustic Tomography, Biomedical Optics, Acoustic Energy Harvesting

Laser - Photoacoustic Application in Biology and Medicine

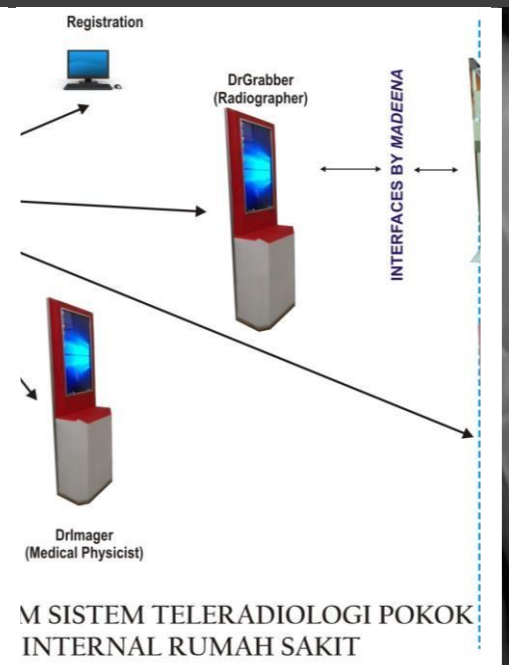




Prof. Dr. Gede Bayu Suparta



1. X-Ray Digital Radiography for Medical purposes.
2. X-Ray Digital Radiography and Computed Tomography for material studies.
3. X-Ray Digital Radiography and Computed Tomography for Industry.
4. Imaging Methods using Photoacoustics; Ultrasonics; Induced Laser; also Infra Red, Visible and Ultra Violet Lights.
5. ***Least but not less***: Inverse Problem, Mathematical Formulation, Computational Approach and Software Development.



Medical X-Ray Digital Radiography System (*Physics of Imaging in Medical Implementation*)

Material Fungsional

3 Professors

Prof. Dr. Harsojo, SU

Prof. Dr. Kuwat Triyana, M.Si.

Prof. Dr. Yusril Yusuf, M. Si.

3 Associate Professor

Dr. Eng. Edi Suharyadi, M. Eng.

Dr. Juliasih Partini, Mr. Si.

Dr. Moh. Adhib Ulil Absor, M.Sc.

3 Lecturer

Dr. Eng. Ahmad Kusumatmadja, M.Si.

Dr. Chotimah, M.Si

Dr. Eng. Ari Dwinugraheni, M.Si.

Expert Assistant &; Teaching Staff

Muh. Darwis Umar, M.Si.

Muh. Arifin, M.Sc.

Devi Pramudyah Wardani, M.Sc.

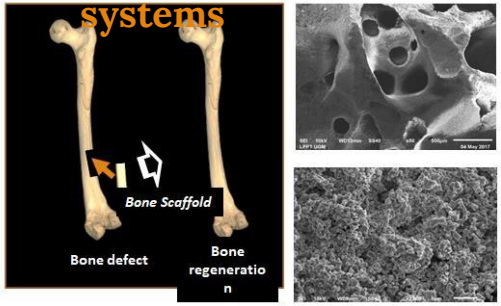
Ibnu Jihad, M.Sc.

Kelompok-kelompok Riset pada KBK FMF

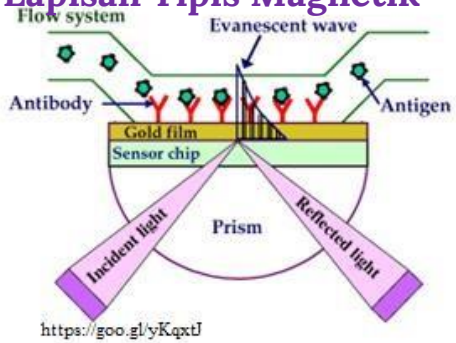
UNIVERSITAS GADJAH MADA

(i) Sensor research group and sensor systems

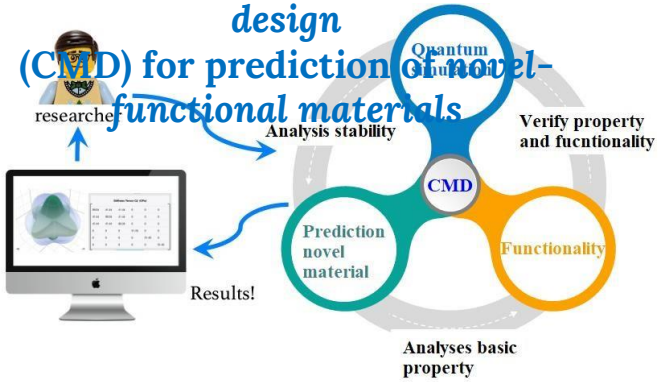
(ii) Development of biomaterial systems



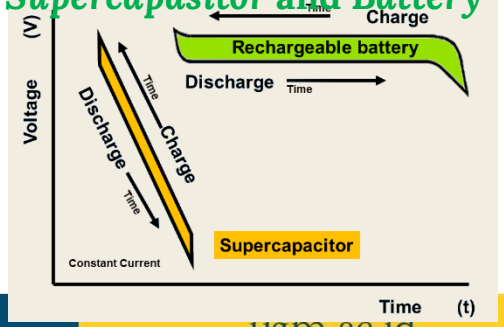
(iii) Multifunctional materials based on nanostructures and Lapisan Tipis Magnetik



(v) *Computational material design* (CMD) for prediction of novel-functional materials



(iv) Development of functional materials for *Supercapasitor and Battery*



Research group I: field of sensors and sensor systems

UNIVERSITAS GADJAH MADA

Team:

1. Prof. Dr. Kuwat Triyana, M.Si. (PIC)
2. Dr. Eng. Ahmad Kusuma Atmdja

Sources Funding:

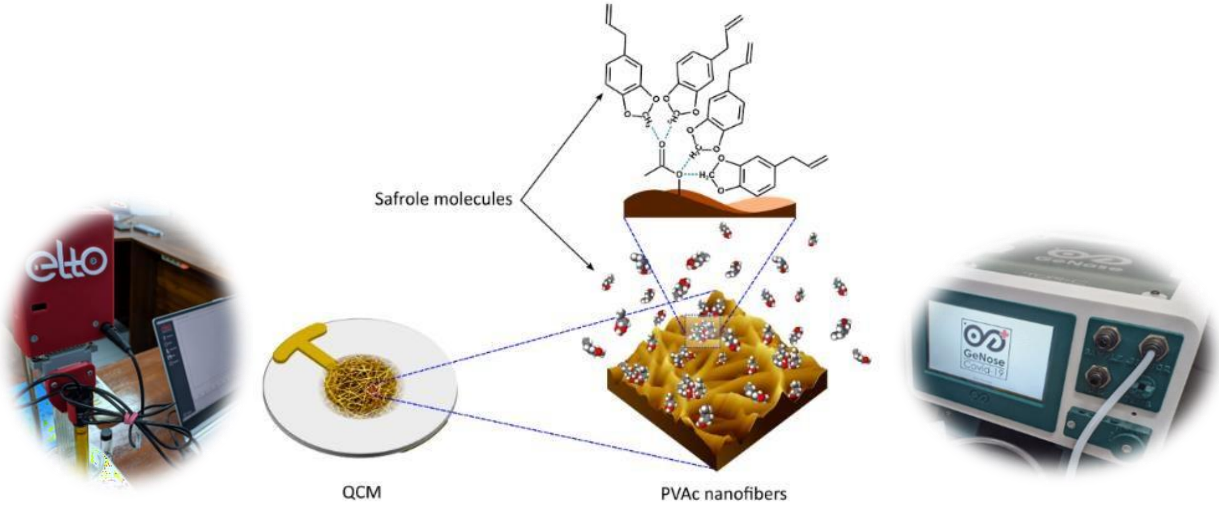
1. RISTEK-BRIN (Scheme: PTUPT, PT, Higher Education Research Consortium, PMDSU)
2. UGM (RTA)

Collaboration:

1. Dr. Roto, M.Si. (Kimia, UGM)
2. Dr. Aditya Rinjanu (Fisika, ITERA)
3. Dr. Hutomo Suryo Wasisto (Technische Universitat Braunschweig).

Research Focus (2021-2026):

- ✓ Development of quartz crystal microbalance *(QCM)-based sensor systems* along with innovation in developing devise sensors using *artificial intelligent* (AI)
- ✓ Produk: Devais sensor *electronic nose* (GeNose) dan *electronic tongue* (ELTO).



QCM: Quartz crystal microbalance

Research on the application of e-nose in the medical field

UNIVERSITAS GADJAH MADA

Detection Covid

Profiling test in the isolation room of Bhayangkara Hospital and Bantul Covid Special Field Hospital. Standard and safety tests at BPFK Surabaya, diagnostic tests at 9 hospitals

Important stages: protocol published in clninicaltrials.gov, LHU from BPFK, production permit from the Ministry of Health, distribution permit from the Ministry of Health (in progress)

Detection of sepsis in neonatals (2019)

Neonatal fecal sampling in the NICU of Dr. Sardjito Hospital. Sample testing at Microbiology Lab FKKMK UGM

Drug detection (2016-2020)

Collaboration with the National Police Headquarters and DIY Regional Police, developing e-nose for drug testing such as gorilla tobacco, and raw *ecstasy*

Tuberculosis Detection

Uji profiling by RS Respira dan RSUP Surakarta

Other

Preparation of e-nose application in the field of

Other medical is for the detection of respiratory and forensic problems.

Research group II: biomaterials development

UNIVERSITAS GADJAH MADA

Team:

1. Prof. Dr. Yusril Yusuf, M.Si. (PIC)
2. Dr. Chotimah, M.Si.
3. Dr. Eng. Ari Dwi Nugraheni, M.Si.

Sources Funding:

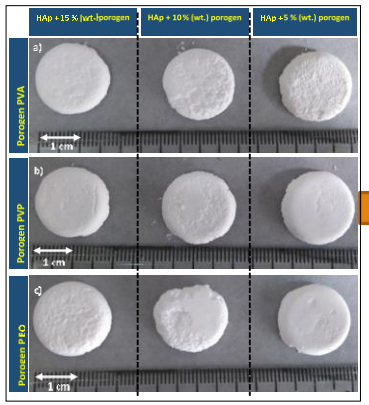
1. RISTEK-BRIN (Skema: PDUPT, PT, World class research, PMDSU)
2. UGM (RTA)

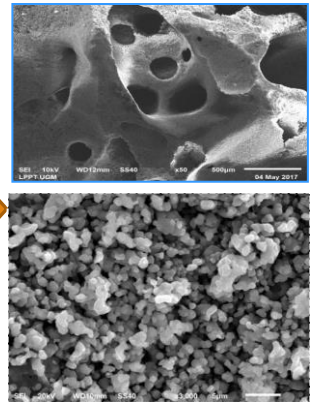
Collaboration:

1. Dr. Ika Dewi Ana, M.Si. (FKG, UGM)

Research Focus (2021-2026):

- ✓ Biomaterial → basic ingredients of Hydroxyapatite (HAp) and Carbonate of Hydroxyapatite (CHAp) from natural materials such as rice snail shells and clam shells.
- ✓ Development of HAp and CHAp materials for *scaffold fabrication* → porous and *biodegradable* materials that function as extracellular matrix materials and support bone cell structures, support the bone regeneration process and also become a good medium for bone growth.





Research group III: Multifunctional materials Nanostructures and Thin Layer based Magnetic

UNIVERSITAS GADJAH MADA

Team:

1. Dr. Eng. Edi Suharyadi, M.Eng. (PIC)
2. Dr. Muhammad Arifin
3. Devi Pramudyah Wardani, M.Sc.

Sources Funding:

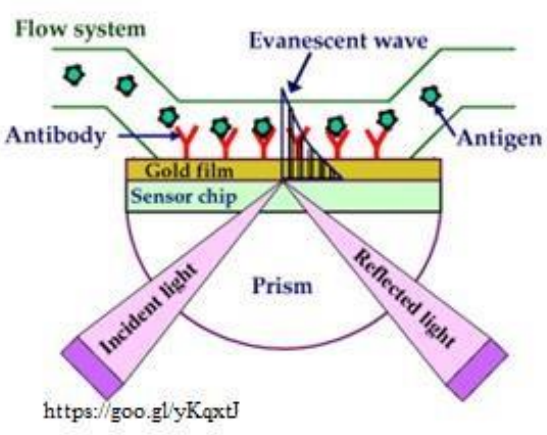
1. RISTEK-BRIN (Skema: PTUPT, PD)
2. Nagoya University → (Japan)
3. UGM (RTA)

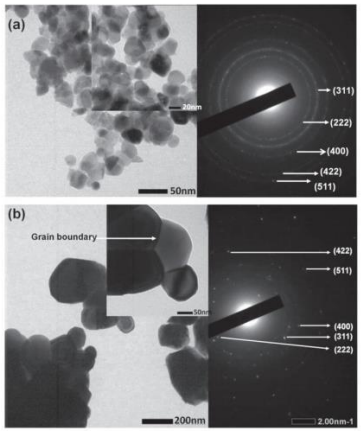
Collaboration:

1. Prof. Takeshi Kato (Nagoya Univ, japan)
2. Prof. Satoshi Iwata (Nagoya Univ, japan)
3. Prof. Keisuke Ohno (Saga Univ, Japan)

Research Focus (2021-2026):

- ✓ Innovation and development of multifunctionalmaterials and its applications are focused on nanoparticle systems and magnetic thin layers.
- ✓ Some of the research conducted focused on the application of (1) photocatalyst materials for degradation of dye waste, (2) active materials and signal amplifiers *on surface plasmon resonance (*SPR)-based biosensors, and (3) label materials on giant magnetoresistance (GMR) biosensor systems .





Kelompok riset IV: Pengembangan material fungsional untuk *supercapasitor* dan *battery*

UNIVERSITAS GADJAH MADA

Team:

1. **Prof. Dr. Harsojo, SU. (PIC)**
2. **Prof. Kuwat Triyana, M.Si**

Sources Funding:

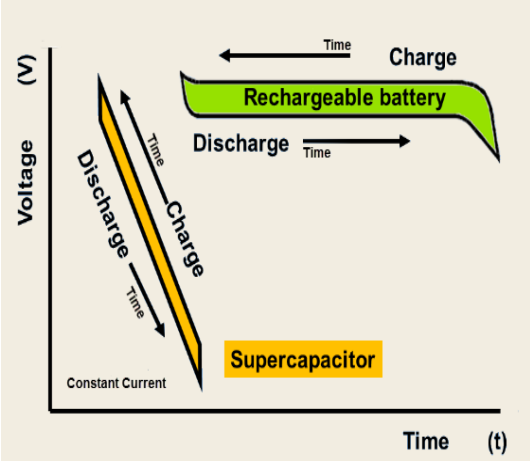
1. **RISTEK-BRIN (Skema: PDUPT, PT)**
2. **UGM (RTA, BPPTBH)**

Collaboration:

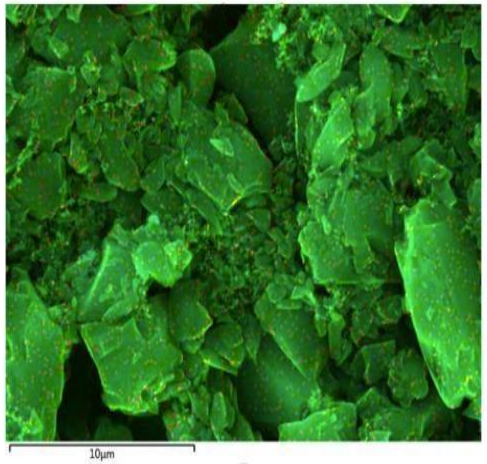
1. **Maryati Doloksaribu (Medan State University)**

Research Focus (2021-2026):

- ✓ Innovation and development of multifunctional materials for *supercapacitor* and *battery* applications focused on *carbon-based* nanomaterial systems such as *graphene oxide*.
- ✓ Result: Material-based performance supercapacitors MnO/Carbon Active (CA)



MnO/CA



Kelompok riset V: Computational material design (CMD) For the prediction of novel-functional materials

UNIVERSITAS GADJAH MADA

Team:

1. Dr. Moh. Adhib U. A., M.Sc. (PIC)
2. Prof. Dr. Harsojo, SU.
3. Dr. Juliasih Partini, M.Si.
4. Ibnu Jihad, M.Sc.

Sources Funding:

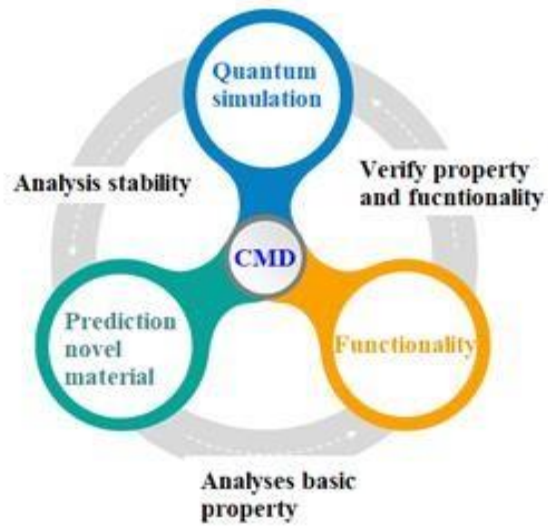
1. RISTEK-BRIN (Skema: PDUPT, PD)
2. Nanomaterial Research Institute Kanazawa Univ, Japan MEXT
3. UGM (RTA)

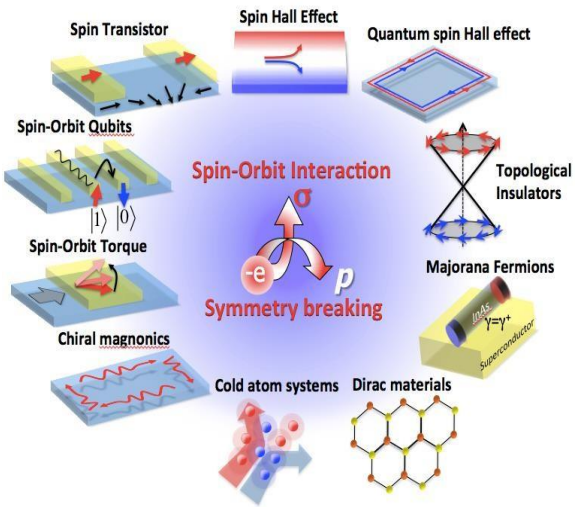
Collaborator:

1. Prof. Fumiyuki Ishii (Nanomaterials Research Institute, Kanazawa Univ, japan).
2. Dr. Naoya Yamaguchi (Nanomaterials Research Institute, Kanazawa Univ, japan).
3. Dr. Iman Santoso, (KBK Theoretical Physics and Computational, UGM Physics)

Research Focus (2021-2026):

- ✓ Development and implementation *of state of the art* material computational methods, namely density-functional theory *(DFT) methods for predicting, analyzing, and designing* novel materials.
- ✓ Hasil: *2D material databased for spintronics: transition metal dichalcogenide, dan group IV monochalcogenide, dan* family GaXY (*X=S,Se,Te ; Y*=Cl,Br,I)





Research facility and student mobility:

UNIVERSITAS GADJAH MADA

❖ Research facilitis supporting KBK FMF:

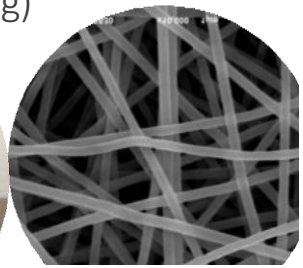
- **Access on Instrumentation materials physics laboratory, UGM Physics: computational materials, synthesis, characterization, analysis and Testing.**
- **Access to UGM's integrated research and testing laboratory (LPPT): synthesis, characterization, analysis and testing.**
- **Access material computing facilities on *ITO Kyushu University Japan*'s supercomputer.**

❖ Student mobility KBK FMF:

- ***Student exchange program* (*Sakura Science Program,* Cooperation with Mie Univ, Japan, and ITB, for the field of computational materials.**
- **Visiting research for access to the use of material research facilities at Nagoya university.**
- **Double degree program (computational science) dengan Kanazawa University untuk program master.**

QCM-based sensor characterization tool (calibrated)

Nanofiber Fabrication Machine (electrospinning)

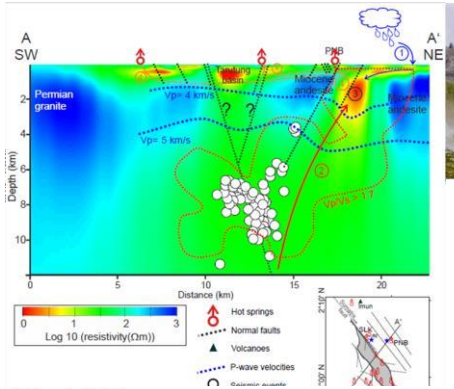


Material computing facilities

Who is KBK-GEOSAINS?
A group of lecturers with geophysical and earth expertise who develop education, research and service based on their expertise.

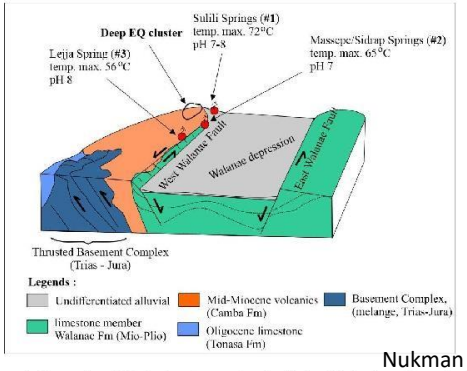
- Members: 15 Lecturers
  - 1 Professor: Prof. Sismanto
  - 1 Associate Professor: Dr. Wahyudi
  - 10 Doctorates
  - 2 Masters
- Supporting HR
  - 2 Technician / laboratory worker
  - 2 Administrative personnel
  - 1 Finance

Research Field: Geothermal Exploration



(Niasari, 2015)

3D Inversion of Satellite Gravity Data on The Telomoyo, Java, Indonesia, 2019. Gravity satellite data analysis for subsurface modelling in Mount Merapi-Merbabu, Java, Indonesia, 2018.

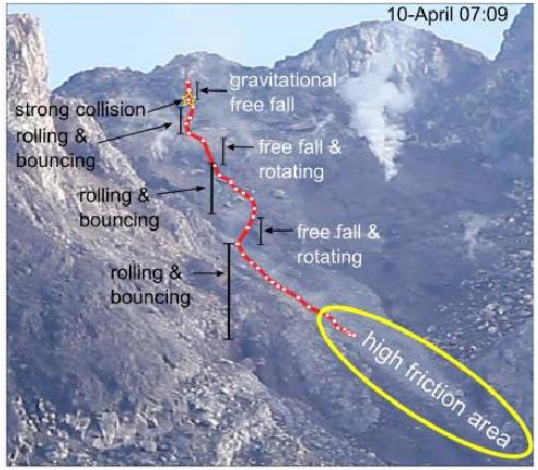


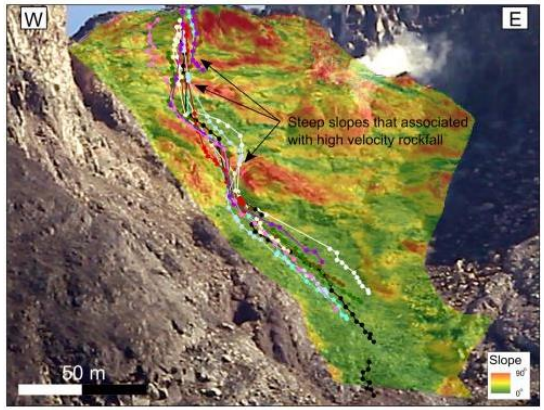
Nukman et al, 2021

- Research topics:
  - *Structural control on springs in South Sulawesi* (Dr. Moch. Nukman dan Dr. Ade Anggraini)
  - *Analog modeling: Sandbox and faulting mechanism (*Dr. Moch. Nukman*)*
  - *Adding geology insight into geophysics work across Java* (Dr. Moch. Nukman dan Drs.Imam Suyanto, MSi.)
  - Geothermal Exploration using Magnetotelluric method and geological observation (Dr. Sintia W Niasari – Dr. Moch. Nukman)

Research Fields: Seismology, Volcanoes and Disasters

- A combination of remote sensing *(satellite, drone, terrestrial photogrammetry)* and geophysical methods for the assessment of the potential hazard of a volcano (Dr. Herlan Darmawan)
- Analysis of ambient seismic noise from volcanic and non activity vulkanik (Dr. Afif Rahman dan Adam Sukma Putra, MSc)
- Regional Moho Depth Based on Seismology and Gravity Data (Dr. Wiwit Suryanto and Dr. Ade Anggraini)
- Study of the Complexity of Earthquake Structure and Mechanism in Indonesia Using Geophysical Data in Efforts to Mitigate Earthquake and Tsunami Disasters in Eastern Indonesia (Dr. Wiwit Suryanto, Dr. Ade Anggraini, Dr. Sintia W Niasari)
- Pyroclastic flow strength scale of duration and amplitude of seismic signals (Dr. Ade Anggraini, Dr. Herlan Darmawan, and Drs. Imam Suyanto, M.Si.)

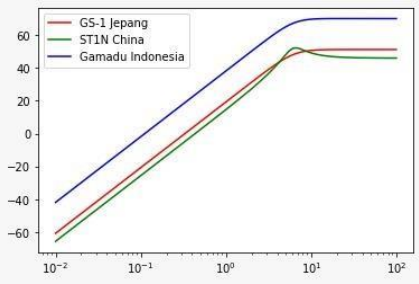


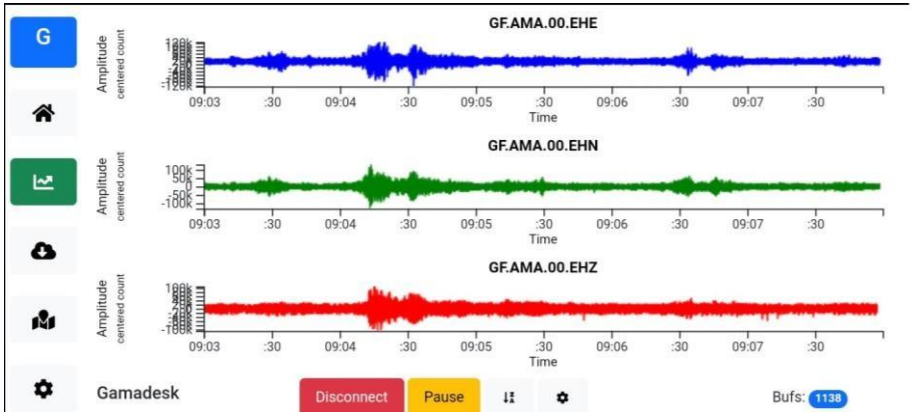


Darmawan et al, JVGR, 2020

Research Field: Computing System, Information and Innovation of Indonesian Earth Instrumentation

- *Subsurface data management based on cloud* (Dr. Sudarmaji)
- Development of Gamadu Indonesia seismometer and Gamadesk operating system (Dr. Wiwit Suryanto, Dr. Wahyudi, Dr. Moch. Nukman, Dr. Ade Anggraini, Dr. T. Marwan Irnaka)
- Development of underwater seismometer and ANT software (PertaGamANT): (Dr. Wiwit Suryanto, Dr. Wahyudi, Dr. T.Marwan Irnaka)
- CO2 Gas measurement instruments in volcanic areas (Dr. Afif Rahman and Dr. Moch. Nukman)
- Geophysical Cloud Based Computational Tool (Dr. Wiwit Suryanto, Dr. T. Marwan Irnaka, Adam Sukma Putra, MSc.)
- *Tweet and Become a citizen scientist: Social Media Crowdsourcing* (Dr. Wiwit Suryanto dan Dr. T. Marwan Irnaka)
- Teoritik dan pemodelan: potensial gravitasi, percepatan gravitasi, *first vertical derivative, second vertical derivative, first horizontal derivative, second horizontal derivative* (Dr. Ari Setiawan)





UNIVERSITAS GADJAH MADA

Research Fields: Geotechnical, Archaeology, Mining and The environment

- Characterisation of soil dynamics parameters and Health of historical sites using geophysical methods (Dr. Eddy Hartantyo, Prof. Sismanto, Drs. Imam Suyanto, M.Si.)
- Mapping the potential for subsidence and landslides using geophysical methods (Dr. Eddy Hartantyo and Dr. Wahyudi)
- Study of clean technology self-potential and electrical resistivity tomography for monitoring water injection (Dr. Wahyudi)

Research Field: Oil Exploration and Gas

- Application of AI *and machine learning* in well log analysis and geophysical data (Dr. Sudarmaji and Dr. Budi Eka Nurcahya)
- Modeling of seismic wave propagation on poroelastic medium (Dr. Sudarmaji and Dr. Budi Eka Nurcahya)
- *Rockphysics: Heat rate and seismic velocity* (Prof. Dr. Sismanto in collaboration with T. Geology)

- *Geosciences, June 2020 DOI: 10.21203/rs.3.rs-36861/v2*
- *Arab J Geosci 13, 726 (2020). https://doi.org/10.1007/s12517-020-05735-7*
- *Geophysics Research Letter*, Volume47, Issue17 16 September 2020 e2020GL089419
- *JVGR*, Volume 404, 15 October 2020, 107010
- (J. Asian Earth Sci., 2019, v.170, p316 -328)
- *Geophysical Journal International,* Volume 216, Issue 1, 1 January 2019, pages 439–452.https://doi.org/10.1093/gji/ggy430
- *Journal of Volcanology and Geothermal Research*, Vol. 349
- *Natural Hazards and Earth System Sciences*, Vol. 18
- *Geosci. Instrument. Metode. Data Syst.*, 6, 319-327, 2017 https://doi.org/10.5194/gi-6-319-2017
- *Computers & Geosciences* Volume 96, November 2016, Pages 77-86 https://doi.org/10.1016/j.cageo.2016.08.006
- Morphological changes at Merapi, JVGR,Nov 2018
- Structural instability NHESS, 2018

Publikasi di jurnal bereputasi (Q1&Q2)

Pengembangan instrumen dan sistem akuisisi realtime: Gamadu Seismometer

Publications and Product Innovations

Introduction to the Field of Science and Community Service

- Education on volcano, earthquake and tsunami disaster mitigation, in collaboration with JICA, BNPB, BMKG
- Socialization of the field of earth science for students and school teachers in DIY
- Socialization of disaster mitigation through mass media (RRI, Kompas print, Harian Jogja, etc.) and webinar forums
- Resource and consulting services for various national strategic projects

Sub field of Excellence Disaster and Environment

Department of Physics:
Volcanoes, Landslides, Earthquakes, Nuclear Disasters, and Disaster Mitigation.

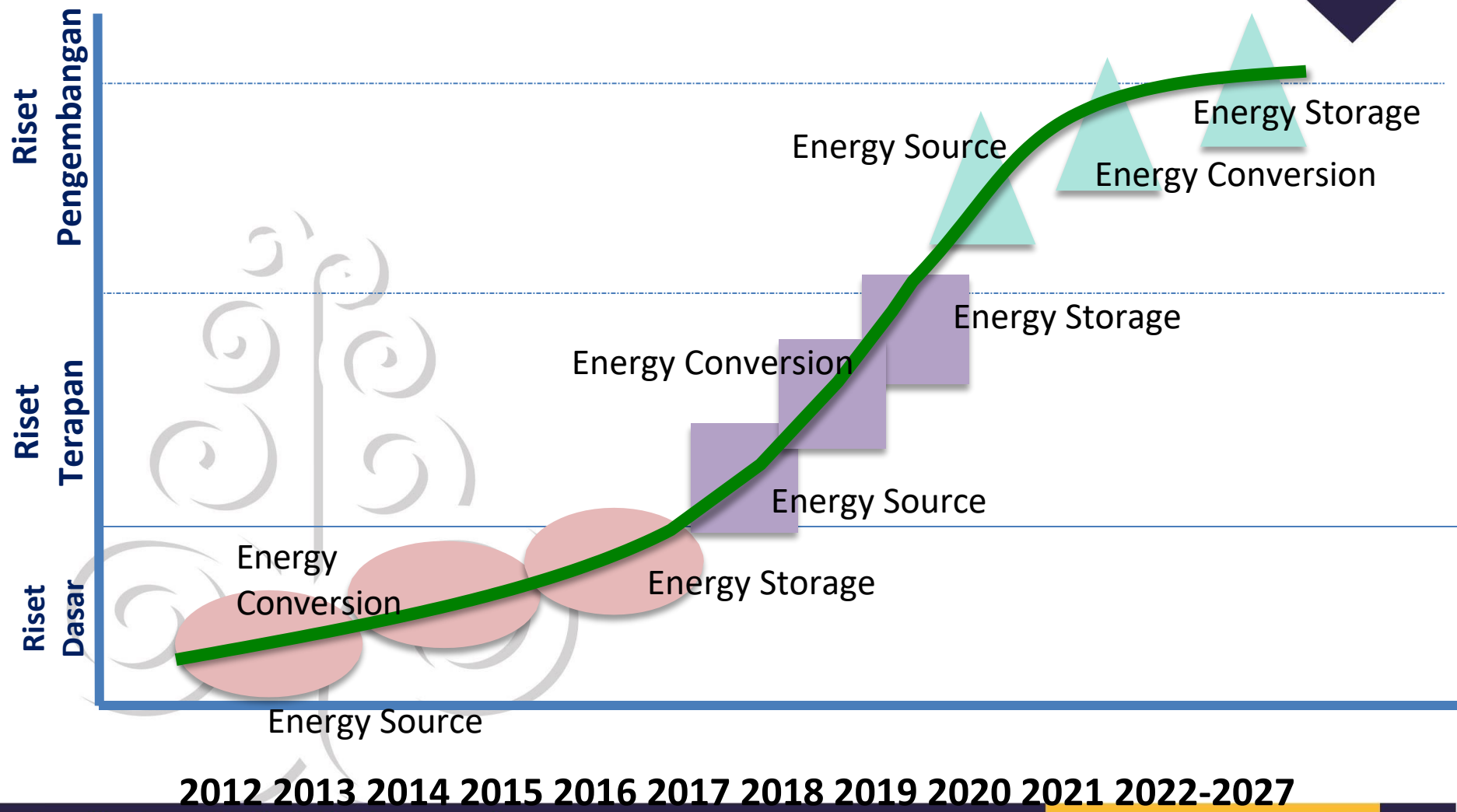
Sub field of Health Excellence

Research Department of Physics

- Image Physics for disease detection
- Biomaterials for bone implants, teeth etc
- Development of tools (SPR, e Nose) for disease detection and harmful compound content
- Development of nanofibers for masks/protection from harmful substances

Sub field of Excellence Energy Security

TAHAPAN PENELITIAN KETAHANAN ENERGI FMIPA UGM



Basic Research (DF, DIKE, DM, and DK)

Energy resources: fossil, solar cell, lithium, coal, biomass, biofuel, water, wind, ocean wave, solar, sound, hydrogen energy source etc.
Conversion (use): generators, superconductors, magnetic materials, chemical energy conversion (biofuels are used as fuel), energy conservation and energy security
Storage : baterai litium, hydrogen storage, fuelcell, accumulator

Applied Research (DF, DIKE, DM, and DK)

Energy resources: energy trading, energy forecasting, high-performance materials (e.g. for nuclear), finding sources of zirconium minerals.
Conversion: instrumentation (saving energy, saving electricity usage) automatic lighting making materials,
Storage : electrical storage (kapasitor, baterai, aki), hydrogen storage.

Development Research (DF, DIKE, DM, and DK)

Energy resources: oil and gas exploration technology
Conversion: vegetable oil, asphalt, lubricant, plastic, biomass into fuel (catalysis technology)
Storage : hydrogen storage, fuel storage

Sub field of Excellence Food Security

Multidisciplinary Research Themes (DF, DIKE, DM, and DK):

1. *Smart synthetic material* : *Humic synthetic*, pupuk ramah lingkungan,
2. *Smart agriculture* : research on modeling soil use functions in accordance with soil conditions etc. with plants, monitoring harvest time, IoT for agricultural processes,
3. *Food security and prediction – prediction* of national food supply needs in the future.
4. *Climate modelling.*
5. Control methods for irrigation systems.
6. Instrumentation and monitoring system for post-harvest and distribution of agricultural products to remain in good condition during storage and distribution.
7. Theoretical Studies and Mathematical Models as tools to support metode, prediction, modelling, computational, dan smart system

Roadmap for Perpetuation to the Community of the Department of Physics FMIPA 2018 – 2023 (5 years)

Assisted Schools in Sleman: Contributing from various scientific fields in FMIPA

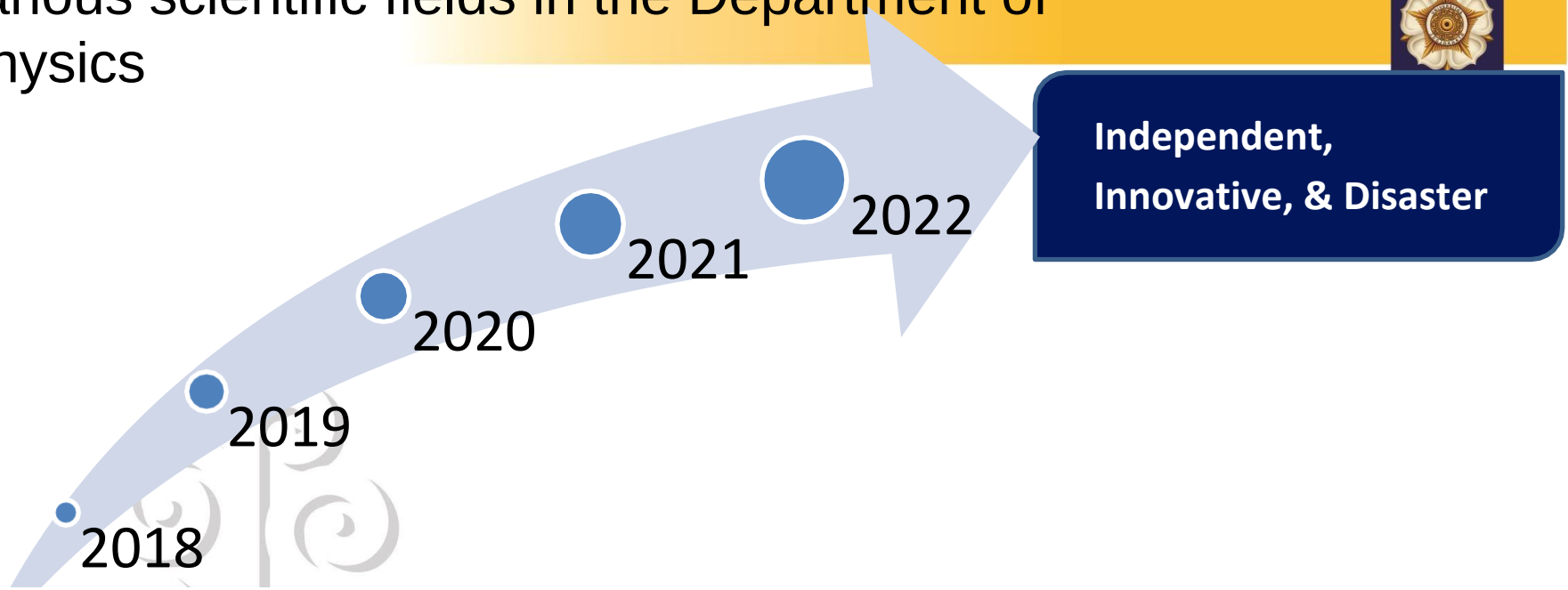
Keywords: Training, supervision, SHE, Disaster Mitigation, KIR, OSN, etc.

2018 → 2019 → 2020 → 2021 → 2022

Excellent, Creative, Innovative, & Responsive to Disasters and environmentally

2018	2019	2020	2021	2022
Preparation and socialization of programs (according to keywords) to target high schools and related agencies. Socialization of FMIPA UGM target school program in target high schools and related agencies.	Establishment of programs to high schools and related agencies. TOR implementation of the FMIPA UGM construction school program.	Material preparation and HR. Syllabus of disaster response and environmental care.	Incorporate disaster mitigation and environmental care materials into the curriculum of appropriate local content subjects.	The achievement of high schools that excel in the field of Mathematics and Natural Sciences and respond to disasters and are environmentally friendly.

Assisted Villages in Sleman: Contributing from various scientific fields in the Department of Physics



2018	2019	2020	2021	2022
Preparation and dissemination of programs to target villages and related institutions. Socialization of FMIPA UGM assisted village program in Sleman and related institutions/agencies.	Monitoring the program to target villages and related agencies/institutions. TOR implementation of the FMIPA UGM construction village program.	Material preparation and HR. Disaster response and environmental care materials.	Program implementation in communities in assisted villages.	Achieving an independent, innovative and responsive village to disasters and caring for the environment (Smart Village as a model).