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Keywords

Plasma; Multi-Physics Modeling; High-Voltage Experiments; Data Analysis; Solid Dielectric Breakdown; Rock Mechanics; Project Management and Coordination; Interdisciplinary tasks.

Experience

- 2018 - Now** **Scientific Assistant**, Geothermal Energy and Geofluids, ETH-Zurich, Switzerland
Tasks Multi-Physics Modeling - Planning and Executing Experiment - Reporting - Coordinating
- 2021 - 2022** **Guest Researcher**, Fraunhofer IEG, Bochum, Germany
Tasks Operating High-Voltage Experiments - Troubleshooting Marx Generator - Data Analysis
- 2017 - 2018** **Research Intern**, National Fusion Laboratory, CIEMAT, Madrid, Spain
Tasks Impurity transport Modeling - Coding - Data analysis of X-Ray tomography
- 2015 - Now** **Affiliated Researcher**, Physics Department, Mansoura University, Egypt
Tasks Teaching & Research - On hold for study leave

Education

- 2018-2024** **Dr.sc ETH Zurich**, ETH-Zurich, Switzerland
Supervisor Prof. Dr. Martin O. Saar
Thesis Title Numerical and Experimental Investigation of the Plasma-Pulse Geo-Drilling Technology
- 2016-2018** **MSc in Fusion Plasma**, Ghent University, Belgium & Stuttgart University, Germany
Supervisor Dr. José M. García-Regaña
Thesis on Advanced neoclassical impurity transport modeling in Stellarators ([Link](#))
- 2011-2015** **BSc in Physics**, Mansoura University, Egypt. **Excellent with honor (Ranked 1st)**

Projects

- 2018-Now** **Plasma-Pulse Geo-Drilling (PPGD)** is a research project funded by *Innosuisse*, hosted by the GEG group at ETH Zurich. PPGD aims to (1) understand the physics of the electric breakdown in the rock via numerical modeling and (2) examine the impact of the deep wellbore conditions of temperature and pressure on the PPGD performance via lab experiments.
- Co-managing this interdisciplinary project.
 - Coordinate the collaboration with the academic/industrial partners.
- Contribution - Execute Multi-Physics Modeling, including electrostatic modeling, plasma, and rock mechanics.
- Co-plan, co-design, and co-execute high voltage experiments.
 - Data analysis and reporting of the results in scientific journals (see the Publication Section).

Skills

Numerical	Multi-Physics	COMSOL & MOOSE
	Plasma Modeling	ZAPDOS & EUTERPE
	Electromagnetics	Microwave Reflectometry & Microwave Propagation
	Coding	Python, MATLAB, SQL, PHP, CSS and HTML

Experimental	Experiments	Electric breakdown in rock Under high-voltage pulses
	High-Voltage	Marx generators & Capacitive Voltage Dividers & Media couplers
	Rock Mechanics	Mechanical failure tests & Failure envelope construction
	Data analysis	Write Python scripts for data analysis

Publications



Scopus*



- [5] **Ezzat, M.**; J. Beorner; B. Kammermann; E. Rossi; B.M. Adams; V. Wittig; J. Biela; H-O. Schiegg; D. Vogler; and M.O. Saar *Impact of Temperature on the Performance of Plasma-Pulse Geo-Drilling (PPGD). Rock Mechanics and Rock Engineering*, **2024**, 15, 250. doi.org/10.1007/s00603-023-03736-y
- [4] **Ezzat, M.**; Adams, B.M.; Saar, M.O.; Vogler, D. *Numerical Modeling of the Effects of Pore Characteristics on the Electric Breakdown of Rock for Plasma Pulse Geo Drilling. Energies*, **2022**, 15, 250. doi.org/10.3390/en15010250
- [3] **Ezzat, M.**; Vogler, D.; Saar, M.O.; Adams, B.M. *Simulating Plasma Formation in Pores under Short Electric Pulses for Plasma Pulse Geo Drilling (PPGD). Energies*, **2021**, 14, 4717. doi.org/10.3390/en14164717
- [2] Horacek, J., et al., **M. Ezzat**, et al., Scaling of L-mode heat flux for ITER and COMPASS-U divertors, based on five tokamaks, *Nuclear Fusion*, **60/6**, **2020**.
- [1] Ascasibar, E., et al., **M. Ezzat**, et al., J. M. García-Regaña, et al., and the TJ-II team, Overview of recent TJ-II stellarator results. *Nuclear Fusion*, **59/11**, **2019**.

Internships

- 26.2-3.3.2018 Studying landau damping using VLASOV code:** In this hands-on project, we studied the competition between Landau damping and collision. IRFM, CEA Cadarache, France.
- 19-23.02.2018 Analysing COMPASS data for the heat flux decay length:** We developed a python script to automatically analyze the divertor-probes data of COMPASS Tokamak, thereby constructing the heat flux profile. Ultimately, our work has been implemented in a published paper. We performed this work at IRFM, CEA Cadarache, France, and we accessed the COMPASS data remotely using the ABACUS cluster of IPP, Prague, Czech Republic.
- 03-16.12.2017 Shoulder formation vs Collisionality campaign@COMPASS:** My task was calculating the diverotr-collisionality profile using the divertor-probes array. I had created a python routine for data acquisition, analysis, and constructing the collisionality profile, eventually. COMPASS Tokamak, IPP, Prague, Czech Republic.

References

- Prof. Martin Saar** **Chair of Geothermal Energy and Geofluids**, ETH-Zürich, Switzerland. ([Profile](#))
Ph.D. Supervisor - Email: saarm@ethz.ch & Tel: +41 44 632 3465
- Dr. Daniel Vogler** **Former Senior Research Assistant**, Geothermal Energy and Geofluids, ETH-
Ph.D. Co-Supervisor Zürich, Switzerland. ([Profile](#)) - Email: davogler@ethz.ch
- Dr. Benjamin Adams** **Former Post-Doctoral Associate**, Geothermal Energy and Geofluids, ETH-
Ph.D. Co-Supervisor Zürich, Switzerland. ([Profile](#)) - Email: adam0068@umn.edu






Dr. José M. G. Regaña Post-Doctoral Associate, National Fusion Laboratory, CIEMAT, Madrid, MSc Supervisor Spain. Email: jose.regana@ciemat.es & Tel: +34 91 346 6434

Prof. Waleed Moslem Head of Physics Department, Faculty of Science, Port Said University, Egypt. CO-Organizer, Plasma School ([Profile](#)) - Email: wmmoslem@sci.psu.edu.eg & Tel: +20 1092529985



Dr. Jan Horacek Institute of Plasma Physics, Prague, Czech Republic. ([Profile](#)) Internship Supervisor Email: horacek@ipp.cas.cz & Tel: +420 731879237

Prof. Essam Abulwafa Emeritus Professor, Faculty of Science, Mansoura University, Egypt. BSc Thesis Supervisor ([Profile](#)) - Email: abulwafa@mans.edu.e & Tel: +20 1000722805

Schools

- 11-15.09.'17 **IPP Summer University for Plasma Physics and Fusion Research**, Max-Planck Institute of Plasma Physics, Garching, Germany.  Max-Planck-Institut für Plasmaphysik
- 21-25.08.'17 **Plas@Par Summer school**, Plas@Par, Banuyls Sur Mer, France. 
- 20-24.03.'17 **9th ITER International School (Disruptions and Control)**, Aix Marseille University, France. 
- 10-17.07.'16 **PlasmaSurf School on Plasma Physics, Intense Lasers and Nuclear Fusion**, IPFN, Lisbon University, Lisbon, Portugal. 
- 25-27.05.'16 **1st Spring Plasma School**, Port Said University, Port Said, Egypt. 
- 12-14.10.'15 **2nd Workshop in Plasma Physic**, Port Said University, Port Said, Egypt.

Other scientific activities

- 2017-present **Co-Founder** of the Egyptian Plasma Society (EGYPlasma ).
- 2018-present **Co-Organizer** of the Spring Plasma School, Egypt, (Sponsors: BUE, ICTP and AVHF).
- 2019-present **Co-Organizer** of the Basic Plasma Summer Course, Egypt, (Sponsors: BUE and AVHF).
- 2018-present **Co-Organizer** of the FusionEPtalks, Fusion-EP and FuseNet .