

Ad hoc Workshop on Magnetized Dusty Plasmas

October 19 – 21, 2009
Auburn University, Auburn, Alabama

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Project history (I)

- To best of my recollection – which is beginning to get bad!
- Genesis: a discussion at APS-2008 with Dick Berger (NSF)
 - Bob, Marlene, Jeremiah(?), and I
 - Posed an question: “What is the next BIG/OPEN/UNRESOLVED area of work in dusty plasmas?”
 - After some discussion, we told him that a magnetized dusty plasma experiment would open up a new regime of experiments
 - Bob(?) mentioned that “significant resources” (read – money!), would likely be needed because of the experimental parameters – probably over \$1 million.
 - Overall, Dick was quite encouraging and told us to get him some information and he could help us develop a path forward.

Project history (II)

- Proposed path:
 - Begin to develop some preliminary calculations that can show that proceeding with an magnetized dusty plasma experiment is viable.
 - Request funding for a small community workshop to broaden participation and “buy-in” into the project.
 - Possibly use the NSF-EAGER (EARly-concept Grants for Exploratory Research) mechanism to get research funding for preliminary experiments (possibly with MPE?).
 - Use the NSF-MRI (Major Research Instrumentation) mechanism to acquire funding to support the construction of the experiment.

Project history (III)

- Proposed path (continued):
 - Because of the anticipated project cost (>\$1 million) and technical scope, consider pursuing as a community-wide project – i.e., a user facility.
 - Long-term funding issues
 - Consortium of organizations -> Center?
 - Individual grants
 - Multiple agencies (DOE / NASA)

Project history (IV)

- **Actual path:**
 - In December, 2008, I contacted Bob and Marlene and we began a series of e-mail and phone conversations to define the scientific and technical scope of a magnetized dusty plasma experiment.
 - By March, 2009 we had made good progress on some preliminary calculations and some initial design criteria. We submitted an NSF conference proposal to support this workshop.
 - In May, 2009, NSF announced the MRI-R² competition – a second Major Research Instrumentation competition for FY2009 funded through the “stimulus” package.
 - Also, in May, 2009, Marlene and I made a presentation on our initial work at the Dusty Plasma Workshop in Boulder.
 - I also announced our intention to try to accelerate the process and submit to the MRI-R².

Project history (V)

- **Actual path (continued):**
 - May to June, 2009 – began an intense process of trying to define the parameters for the experiment: magnet parameters, vacuum vessel design, safety and control systems, diagnostics, etc.
 - June, 2009 – visited MPE and had an excellent discussion with Uwe and with Greg about a partnership on this project.
 - June, 2009 – We did not win the internal Auburn competition for MRI-R². This was a setback, but it turns out this may have been for the best.
 - Summer, 2009 – Continued work on design at a slower pace, but continued to make progress: obtained cost estimate for major subsystems.
 - August, 2009 – Began discussions with Joe Minervini of the MIT Plasma Science and Fusion Center – Magnet Design group.

Current Status (I)

- ***On-going discussions with funding agencies:***
 - Dick Berger has completed his rotator position at NSF. Steve Gitomer (LANL, IEEE TPS) is the new rotator as of Oct. 1.
 - NSF MRI is in “limbo” for FY 2010.
 - House removed MRI funding because of the two MRI activities in FY 2009.
 - Senate has kept funding for MRI in FY10.
 - This difference is not yet resolved.
 - The MRI program involves “acquisition” and “development” grants.
 - The rules for each are different.
 - I discussed this issue with Dr. Kathleen McCloud (Physics Division MRI coordinator) – this project falls under the “development” category.
 - “Development proposals are characterized by a demonstrated need for new or upgraded instruments that can **provide enhanced or potentially transformative use and performance**, **open up new areas of research and research training**, and/or have potential as commercial products. “
 - Initiated a conversation with Mike Crisp of Dept. of Energy about possible support (using a model like UCLA or Univ. Wisconsin).

Current Status (II)

- **Technical and scientific status:**
 - A “zero-level” baseline design has been developed. Preliminary cost estimate for proposal: **\$2 million (NSF)** + **\$0.85 million (matching)**.
 - Vacuum vessel [\$50k]
 - Superconducting magnets [\$1.2 million]
 - Infrastructure [\$250k]
 - Electrical power, cooling, data storage (partial)
 - Diagnostic systems (partial)
 - Control systems (partial)
 - Safety systems (partial)
 - “First draft” of scientific questions.
 - As a dusty plasma is taken from an unmagnetized system through a progression of regimes where first the electrons, then the ions, and then the charged dust become magnetized - how do the structural, thermal, charging, and instability properties of the dusty plasma evolve?
 - If a dusty plasma is composed of microparticles that have paramagnetic or ferromagnetic properties, how do the properties of the dusty plasma evolve in the presence of uniform and non-uniform magnetic fields?

Current Status (III)

- ***Building a community of users:***
 - NSF requirements on “large” MRI proposals
 - “Proposals requesting **over \$2 million** must address the potential impact of the instrument at both the **National level and on the research community of interest**. Concrete plans for enabling access by external users (including those from **non-Ph.D. and/or minority-serving** institutions) through physical access and/or **cyberinfrastructure** must be presented, and the uniqueness of the requested instrumentation must be described.”
 - This project must “do no harm”!
 - We will need to convince the agencies that support of this project – even as a user-facility – should not have a negative impact on individual research programs.
 - This project should add to the richness and breadth of work in the community, and not be used to restrict opportunities, especially for new researchers.
 - Nonetheless, this IS an opportunity for the dusty plasma community to clearly demonstrate that it can come together behind a project that is larger than the sum of its parts.