

From: Robert L. Merlino <robert-merlino@uiowa.edu>

To: gr@geraldrosen.com

Sent: Fri, January 22, 2010 11:02:51 AM

Subject: a 1962 paper of yours

Dear Dr. Rosen:

My name is Bob Merlino and I am a professor in the physics department at the University of Iowa in Iowa City. I am an experimental plasma physicist.

Last week while browsing through some old issues of Physics of Fluids, I came across a 1962 paper of yours on "Method for removal of free electrons in a plasma," (Phys. Fluids 5, 737, 1962). I was intrigued by the title so I read the paper. Very quickly, I realized that this work dealt with what we now call "dusty plasmas", a plasma with embedded micron sized particles. This has become a very active field over the last 20 years or so due mainly to 2 discoveries. In 1980 the Voyager 2 satellite at Saturn sent back detailed images of the rings showing unusual radial structures or 'spokes' in the B ring which evolved on time scales of minutes, far shorter than any possible gravitational timescale. It was realized that these structures were due to charged dust that was being levitated above the ring plane. At about the same time it was discovered in the semiconductor processing industry that silicon wafers were being contaminated by dust particles that were growing due to chemical processes taking place in the plasmas used to etch the wafers. These discoveries of the importance of charged dust in plasmas led to an avalanche of work on dusty plasmas. Of course, the role of dust in astrophysical environments has been known for some time. I have attached an article that a colleague and I wrote for Physics Today back in 2004.

What I want to point out is that in your 1962 paper, you derived (third equation on page 737 right hand column) the equation that we generally use to calculate the charge on a dust particle. Of course your emphasis was on electron removal, which has been reported now many times. (I suspect that you may have had in mind the removal of electrons around a spacecraft during reentry.) The equation that you derived is what is now known as the OML (orbital motion limited) theory of dust charging. As far as I can tell, you arrived at this equation 30 years before anyone else. I suspect that your paper has been missed by the community due for several reasons: the word dust does not appear in the title, there is no abstracts for research notes, and at that time there were no keywords or PACS numbers. I will do what I can to bring your work to the attention of my "dusty" colleagues. I am considering the possibility of submitting a Comment to your paper for the journal Physics of Plasmas (several years ago Plasma Physics was split off from the fluids journal).

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I certainly wish you well and best of luck with your work.

Sincerely,

Bob Merlino