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Dust dynamics and diagnostic applications in quasi-neutral plasmas and magnetic fusion ZHEHUI WANG, CATALIN M. TICOS, JIAHE SI, GIAN LUCA DELZANNO, GIANNI LAPENTA, GLEN WURDEN, Los Alamos National Laboratory — Little is known about dust dynamics in highly ionized quasi-neutral plasmas with ca. 1.0 e+20 per cubic meter density and ion temperature at a few eV and above, including in magnetic fusion. For example, dust motion in fusion, better known as UFO's, has been observed since 1980's but not explained. Solid understanding of dust dynamics is also important to International Thermonuclear Experimental Reactor (ITER) because of concerns about safety and dust contamination of fusion core. Compared with well studied strongly-coupled dusty plasma regime, new physics may arise in the higher density quasi-neutral plasma regime because of at least four orders of magnitude higher density and two orders of magnitude hotter ion temperature. Our recent laboratory experiments showed that plasma-flow drag force dominates over other forces in a quasi-neutral flowing plasma. In contrast, delicate balance among different forces in dusty plasma has led to many unique phenomena, in particular, the formation of dust crystal. Based on our experiments, we argue that 1) dust crystal will not form in the highly ionized plasmas with flows; 2) the UFO's are moving dust dragged by plasma flows; 3) dust can be used to measure plasma flow. Two diagnostic applications using dust for laboratory quasi-neutral plasmas and magnetic fusion will also be presented.

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