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Mode-coupling instability of two-dimensional complex plasma crystals in asymmetric capacitively-coupled radio-frequency discharges

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The dependence of the mode-coupling instability threshold in two-dimensional complex plasma crystals is studied. It is shown that for a given microparticle suspension at a given discharge power there exist two thresholds in pressure. Above a specific pressure p_{max}, the monolayer is always in the crystal phase. Below a specific pressure p_{min}, the crystalline monolayer undergoes the mode-coupling instability and the monolayer is in the fluid phase. In between p_{in} and p_{max}, the crystal will be in the fluid phase when increasing the pressure from below p_{min} until it reaches p_{max} where it recrystallises, while it remains in the crystal phase when decreasing the pressure from above p_{max} until it reaches p_{min}. A simple auto-consistent sheath model can explain the melting threshold as a function of pressure and rf power due the changes of the sheath electric field and the microparticle charges leading to the crossing of the compressional in-plane phonon mode and the out-of plane phonon mode.

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