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**Discovery of an Unexpected Liquid Phase in the Periodically Driven Paul Trap** DANIEL WEISS, Wesleyan University, YUNSEONG NAM, University of Maryland, REINHOLD BLMEL, Wesleyan University — Charged particles confined in a Paul trap generally exist in one of two phases: the cloud phase - characterized by rf heating and chaotic dynamics - and the crystal phase - defined stroboscopically as a period-1 fixed point in phase space, where there is no heating. Here we present evidence supporting the existence of a liquid phase. In contrast to the cloud state, the liquid phase is characterized by an almost negligible heating rate.

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