

Rice professor Thomas Killian authors a review of research on ultracold neutral plasmas in Physics Today.

(<http://ptonline.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PHTOAD000063000003000046000001&idtype=cvips&gifs=Yes>)

Plasmas are collections of charged particles, often involving currents and electromagnetic fields, which can exhibit an impressively diverse set of collective phenomena. Plasmas tend to be hot because collisional energies on the order of an electron-volt (12,000 K) or higher are required to ionize atoms and molecules, but in the last 10 years, a new laboratory plasma has emerged on the scene – ultracold neutral plasmas. They extend the temperature range of neutral and quasi-neutral plasmas by two more orders of magnitude, with electron and ion temperatures as low as 1 K. These new plasmas explore the boundary between traditional plasmas and those where spatial correlations and “strong coupling” become important. They have already revealed surprising new phenomena that teach us about how nature behaves in this extreme regime. The low temperatures and well-controlled creation process also enable a tailoring of plasma conditions and precise diagnostics that allow experimenters to cleanly demonstrate classic phenomena of plasma physics such as collective modes and thermalization.

