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Toward laser cooling of negative lanthanum[1] ELENA JORDAN, GIOVANNI CERCHIARI, STEFAN ERLEWEIN, ALBAN KELLERBAUER, Max Planck Institute for Nuclear Physics, UNIC TEAM — Anion laser cooling holds the potential to allow the production of ultracold ensembles of any negatively charged species by sympathetic cooling. It is a promising technique for cooling of antiprotons to a few mK and could clear the way for precision measurements on cold antihydrogen. Laser cooling of negative ions has never been achieved, since most species have no bound–bound electric dipole transitions. Negative lanthanum (La^-) is one of the few anions with multiple electric dipole transitions. The bound–bound transition from the $^3F_2^e$ ground state to the $^3D_1^o$ excited state in La^- has been proposed theoretically as a candidate for laser cooling. The potential laser cooling transition was identified using laser photodetachment spectroscopy and its excitation energy was measured. We have studied the aforementioned transition in a beam of La anions by high-resolution laser photodetachment spectroscopy. Seven of the nine expected hyperfine structure transitions have been resolved and the transition cross sections have been estimated from experimental observations. It was found that presently La^- is the most promising candidate among the atomic anions. We plan to demonstrate the first direct laser cooling of negative ions in a linear radio frequency trap.

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Elena Jordan
Max Planck Institute for Nuclear Physics

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