ANIONS: Atmospheric Negative ION Sensor. A. M. Rymer[1], J. H. Westlake[1], H. T. Smith[1], K. Strohben[1], and K. Bowen[2] C. D. Author[2], [1]Johns Hopkins University Applied Physics Laboratory, [2]Johns Hopkins University.

One of the most surprising discoveries of the Cassini mission at Saturn has been that of copious quantities of negative ions and negatively charged dust in the atmosphere of Titan and in the ice volcano plumes emerging from the South pole of Enceladus. The physics of plasmas in which significant numbers of electrons are trapped as negative ions is not well understood and we hope that dedicated mass-per-charge measurements of negative ions will be included on future planetary missions. In particular any return missions to Titan or Enceladus, but any environment where the plasma is sufficiently cold and dense will support similar complex heavy negative ion chemistry and measurements that include negative ions should be considered as part of a baseline particles and fields payload. At Titan the peak in the negative ions is in the range 1000-2000 km altitude with peak density typically a few 10s per cc and significant day/night variations observed. At Enceladus negative ions, nanograins and dust are seen below ~600 km altitude with a (mass dependent) density typically < 1 per cc. The ANIONS Instrument concept has been developed to address the challenges associated with making excellent mass-per-charge measurements in these environments. We will describe the science drivers and the ANIONS instrument concept. The challenges and solutions to separate electrons from negative ions in order to make robust measurements anion chemistry in any cold and dense planetary environments where negative ion chemistry will be important.