Advanced Energetic Pair Telescope (AdEPT), a Medium-Energy Gamma-Ray Polarimeter

STANLEY HUNTER, NASA/GSFC, ON BEHALF OF THE ADEPT COLLABORATION — Since the launch of AGILE and FERMI, the scientific progress in high-energy ($E_{\gamma} > 200$ MeV) gamma-ray science has been dramatic. Both of these telescopes cover a broad energy range from about $\sim 20$ MeV to $>10$ GeV. However, a significant sensitivity gap remains in the medium-energy regime ($0.75 - 200$ MeV) that has been explored only by COMPTEL and EGRET on CGRO. Exploring this regime with angular resolution near the kinematic limit and high polarization sensitivity requires a telescope design with a low density electron track imaging detector. The medium-energy ($\sim 5$ to $200$ MeV) Advanced Energetic Pair Telescope (AdEPT), will achieve angular resolution of $\sim 0.6$ deg at 70 MeV, similar to the angular resolution of Fermi/LAT at $\sim 1$ GeV. AdEPT will also provide unprecedented polarization sensitivity of $\sim 1\%$ for a 1 Crab source. The enabling technology for AdEPT is the Three-Dimensional Track Imager (3-DTI) a low-density, large volume, gas time-projection chamber with a 2-dimensional readout. We describe our ROSES/APRA funded program to build a 50x50x100 cm$^3$ AdEPT prototype, measure the angular resolution and polarization sensitivity of this prototype at an accelerator.