DETECTING COLD DARK MATTER CANDIDATES

A.K. Drukier, K. Freese and D.N. Spergel
Department of Astronomy, Harvard University
60 Garden Street
Cambridge, Massachusetts 02138
U.S.A.

ABSTRACT. We consider the use of superheated superconducting colloids as detectors of weakly interacting galactic halo candidate particles (e.g. photinos, massive neutrinos, and scalar neutrinos). These low temperature detectors are sensitive to the deposition of a few hundreds of eV's. The recoil of a dark matter particle off of a superheated superconducting grain in the detector causes the grain to make a transition to the normal state.[1] Their low energy threshold makes this class of detectors ideal for detecting massive weakly interacting halo particles.[2]

We discuss realistic models for the detector and for the galactic halo. We show that the expected count rate ($\gtrsim 10^3$ count/day for scalar and massive neutrinos) exceeds the expected background by several orders of magnitude. For photinos, we expect $\gtrsim 1$ count/day, more than 100 times the predicted background rate. We find that if the detector temperature is maintained at 50 mK and the system noise is reduced below 5×10^{-4} flux quanta, particles with mass as low as 2 GeV can be detected. We show that the earth's motion around the Sun can produce a significant annual modulation in the signal.[3]

References

[1] Drukier, A.K. and Stodolsky, L. Phys.Rev.D, **30**, 2295 (1984).
[2] Goodman, M.W. and Witter, E. Phys.Rev.D, **30**, 3059 (1958).
[3] Drukier, A.K., Freese, K., and Spergel, D., submitted to Phys.Rev.D.

J. Kormendy and G. R. Knapp (eds.), Dark Matter in the Universe, 490.