Modeling the Pioneer anomaly JACQUES LEIBOVITZ — Scientists continue their attempts to model the observed Pioneer anomaly (PA) as an artifact of measurement or of equipment operation. Scientists also explore "new physics" as a possible explanation, but they have eliminated dark matter (DM). Here, the main arguments used to eliminate DM are refuted and then the anomaly is modeled by application of Newton laws to the observed macroscopic properties of DM. Around a central mass M, the modeling predicts a DM distribution that produces the PA at short distances (R smaller than 188 AU) from a star like the Sun, and a flat rotation curve at sufficiently large distances from the center of a galaxy. Below about 188 AU from the Sun, the modeling predicts that the anomaly may be expressed as PA = 8.3E-8 $\{[R^{(-2)}] - 1\}$ cm $(s)^{(-2)}$. It shows that the anomaly remains fairly constant down to 5 AU, decreases significantly from 5 AU to 1 AU where it becomes zero and changes sign below a distance of 1 AU, then increases rapidly in magnitude as R decreases in that range. Verifiable tests are proposed. Some related topics for future research are proposed.

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