Effective Field Theory Approach to Elastic Scattering of Dark Matter in XENON100 Detector 225 live days run

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I. INTRODUCTION

II. THE XENON100 DETECTOR

The XENON100 detector is a cylindrical (30cm height X 30cm diameter) dual phase Xenon Time Projection Chamber (TPC) that holds 62 kg of Liquid Xe (LXe) targets [1]. It operates at the Laboratori Nazionali del Gran Sasso (LNGS) in Italy. The detector consists a total of 242 1-square Hamamatsu R8520-AL photomultiplier tubes (PMTs) employed in two arrays, at the top part (in the gas phase) and in the bottom immersed in LXe. a Particle interacting with the LXe deposits energy that creates both excited and ionized states. De-excitation creates a prompt scintillation signal ($S1$). , Ionized electrons are drifted in an electric field of 530V/cm towards the liquid-gas interface, where they are extracted via a larger electric field of $\sim$ 12kV/cm. These electrons generates a proportional scintillation, which is called $S2$. The spatial distribution of the $S2$ signal on the top PMT array, determines the X-Y position, while the time difference between the two signals gives the z-coordinate, and thus a 3D position reconstructions is achieved.

The ratio of S2/S1 is different weather the interaction is nuclear recoil (NR) or electronic recoil (ER) and thus this ratio is used as a discriminator between ER background coming from γ, β and NR signal coming from a WIMP.

In previous XENON100 analyses the determination of the recoil energy was based on the size of S1 and the scintillation efficiency for the nuclear recoils, $\mathcal{L}_{\rm eff}$ [2]. However in the last analysis [3] a new method was adopted taking into advantage also the S2 signal.

III. THE ANALYSIS

IV. RESULTS

[1] E. Aprile et al., Astropart. Phys. **35**, 573 (2012).
[2] E. Aprile et al., Phys. Rev. Lett. **109**, 181301 (2012).
[3] E. Aprile et al. (XENON100) (2016), 1609.06154.