7.0 GeV dark matter candidate could be the missing particle in Planck framework

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In a recent paper, Hooper et al. have shown that the excess of low energy events observed by the CoGeNT collaboration and the annual modulation observed for some years by the DAMA and DAMA/LIBRA collaborations could be explained by a dark matter particle with a mass of approximately 7.0 GeV. Such a dark matter candidate could be the missing particle within a framework that relates particle masses to the Planck Mass. Massive particles occupy coincident levels and sublevels within three sequences that descend in geometric progression, with common ratios $1/\pi$, $2/\pi$ and 1/e, from the Planck Mass. The putative fundamental particles are arranged precisely upon or, in partnership, about mass superlevels and their coincidences within sequences with common ratios $(1/\pi)^3$, $(2/\pi)^3$ and $(1/e)^3$. Four close superlevel coincidences, of which three are occupied, occur within the range of mass scales from that of the electron to that of the top quark. The fourth and uniquely precise superlevel coincidence occurs at 7.0 GeV.

Introduction

Hooper et al. have shown that the excess of low energy events observed by the CoGeNT collaboration and the annual modulation observed for some years by the DAMA and DAMA/LIBRA collaborations could be explained by a dark matter particle with a mass of approximately 7.0 GeV [1].

Massive particles, including mixed states, have been shown to occupy mass levels and associated sublevels within three geometric sequences that descend from the Planck Mass [2, 3], $1.220892(61)\times10^{19}$ GeV [4]. The common ratios of the three principal sequences are $1/\pi$ (Sequence 1), $2/\pi$ (Sequence 2) and 1/e (Sequence 3). Sublevels lie within sequences of common ratio $r^{1/p}$, where r is the common ratio of the principal sequence and p is a power of 2 or 3. Many, perhaps all, massive particles lie at the coincidences of levels or sublevels within more than one sequence. The mass level framework may derive from the geometry of Planck-scale extra dimensions [3].

In this paper, we show that the putative fundamental particles are arranged precisely upon or, in partnership, about mass superlevels and their rare coincidences within sequences with common ratios $(1/\pi)^3$, $(2/\pi)^3$ and $(1/e)^3$. The 7.0 GeV dark matter candidate could be the missing particle in the framework.

Values of particle mass used in this paper have been taken from the listings of the Particle Data Group [5].

The arrangement of particles upon mass superlevels

Particle arrangements will be displayed graphically. Each particle is assigned level numbers n_1, n_2 and n_3 in Sequences 1, 2 and 3, respectively. The level number $n = \ln(M_{\text{Planck}}/m_{\text{particle}})/\ln(1/r)$, where r is the common ratio of the sequence. Superlevels,

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for which *n* is a multiple of 3, carry the numbers of the principal sequences. As a convenient way of displaying the superlevels and their coincidences, one sequence of levels is plotted perpendicular to another, as in Figure 1. At any mass value the level number in one sequence is related to that in another sequence via a constant factor. Consequently, all particles will occupy a straight line, shown in blue, upon the graph. Mass level coincidences occur at the intersection of levels upon the blue line.

A 7.0 GeV dark matter particle would occupy Level 93, a superlevel, in Sequence 2, as shown in Figure 1.

The charged leptons evidently form partnerships with charged mesons upon superlevels, as shown in Figure 1. The muon and the charged pions are arranged symmetrically about Level 102 in Sequence 2. The tau lepton and the charged D-mesons are arranged symmetrically about Level 96 in Sequence 2. The electron occupies the coincidence of Level 45 in Sequence 1 with Level 114 in Sequence 2. The electron seems to be partnered by the charged K-mesons which occupy the coincidence of Level 39 in Sequence 1 with Level 99 in Sequence 2: the e-$K^{\pm}$ partnership is centred upon the coincidence of Level 42 in Sequence 1 with Level 48 in Sequence 3, as shown in Figure 2. The mass representative of the partnership is equal to the geometric mean of the two particle masses.

A 7.0 GeV dark matter particle would occupy Level 42 in Sequence 3, as shown in Figure 2.

The weak gauge bosons $W^{\pm}$ and Z^0 form a partnership centred upon Level 34.5, a sublevel, in Sequence 1, as shown in Figure 2.

A 7.0 GeV dark matter particle would occupy the coincidence of Level 93 in Sequence 2 with Level 42 in Sequence 3, as shown in Figure 3. This is the most precise superlevel coincidence in the range of mass scales from that of the electron to that of the top quark. At any mass value the level number in Sequence 2 is $1/\ln(\pi/2) = 2.2144$ times that of the corresponding level number in Sequence 3. The fraction 93/42 is equal to 2.2143.

The strange-charm and bottom-top quark doublets are each centred upon superlevels, in Sequence 3 and Sequence 2, respectively, as shown in Figure 3. The central values of the Particle Data Group evaluations [5] have been used to calculate the mass representative of each doublet, which is equal to the geometric mean of the two particle masses. The strange-charm doublet mass is 358 MeV (strange quark mass ≈ 101 MeV; charm quark mass ≈ 1.27 GeV). The bottom-top doublet mass is 26.8 GeV (bottom quark mass ≈ 4.19 GeV; top quark mass ≈ 172.0 GeV).

Discussion

Particles occupy the coincidences of mass sublevels, levels and superlevels within Sequences 1, 2 and 3. Isospin doublets and other types of partnership resulting from the breaking of symmetries are arranged symmetrically about sublevels, levels and superlevels. In this paper, we have shown that charged lepton-pseudoscalar meson and quark-quark partnerships occupy the superlevels, the $W^{\pm}$-Z^0 partnership occupying a sublevel. Mass superlevel coincidences are rare: only four close

coincidences occur within the range of mass scales from that of the electron to that of the top quark. Two of those coincidences are occupied by the electron and the charged K-mesons while the third lies at the centre of the e-$K^{\pm}$ partnership. The fourth, uniquely precise and conspicuously vacant coincidence would be the domain of a 7.0 GeV dark matter particle.

References

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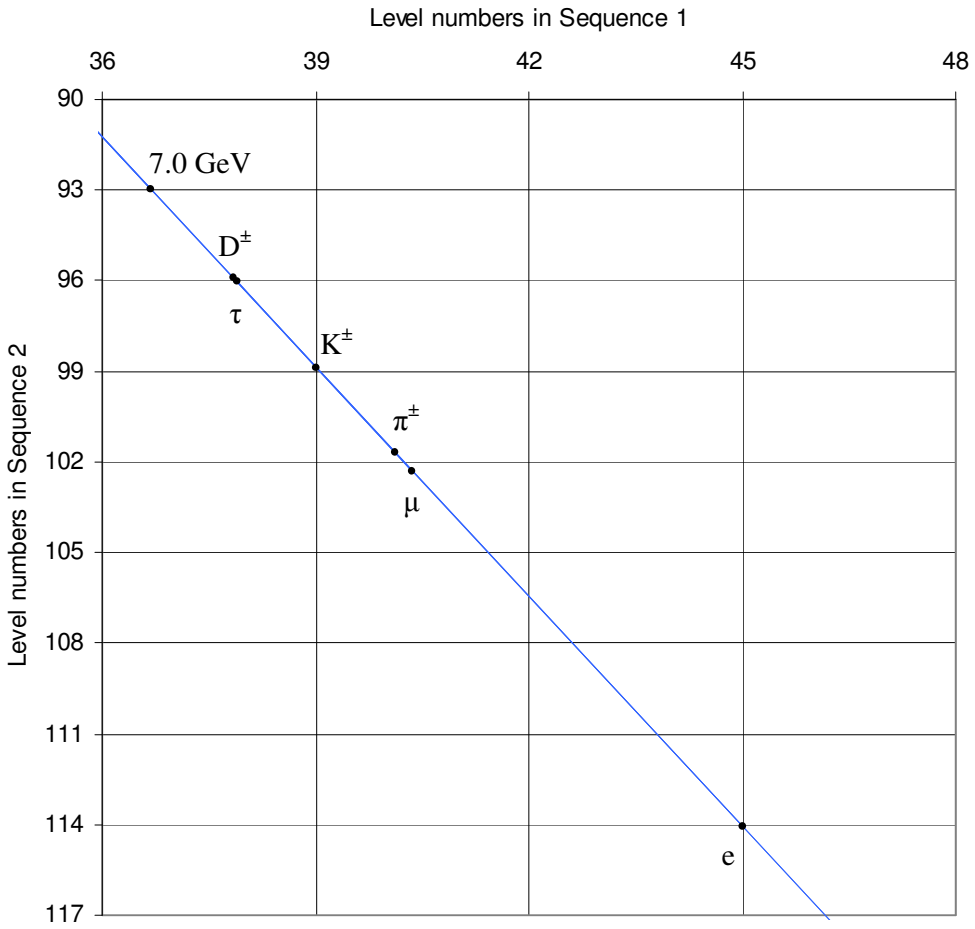

Figure 1: Superlevel occupation in Sequences 1 and 2

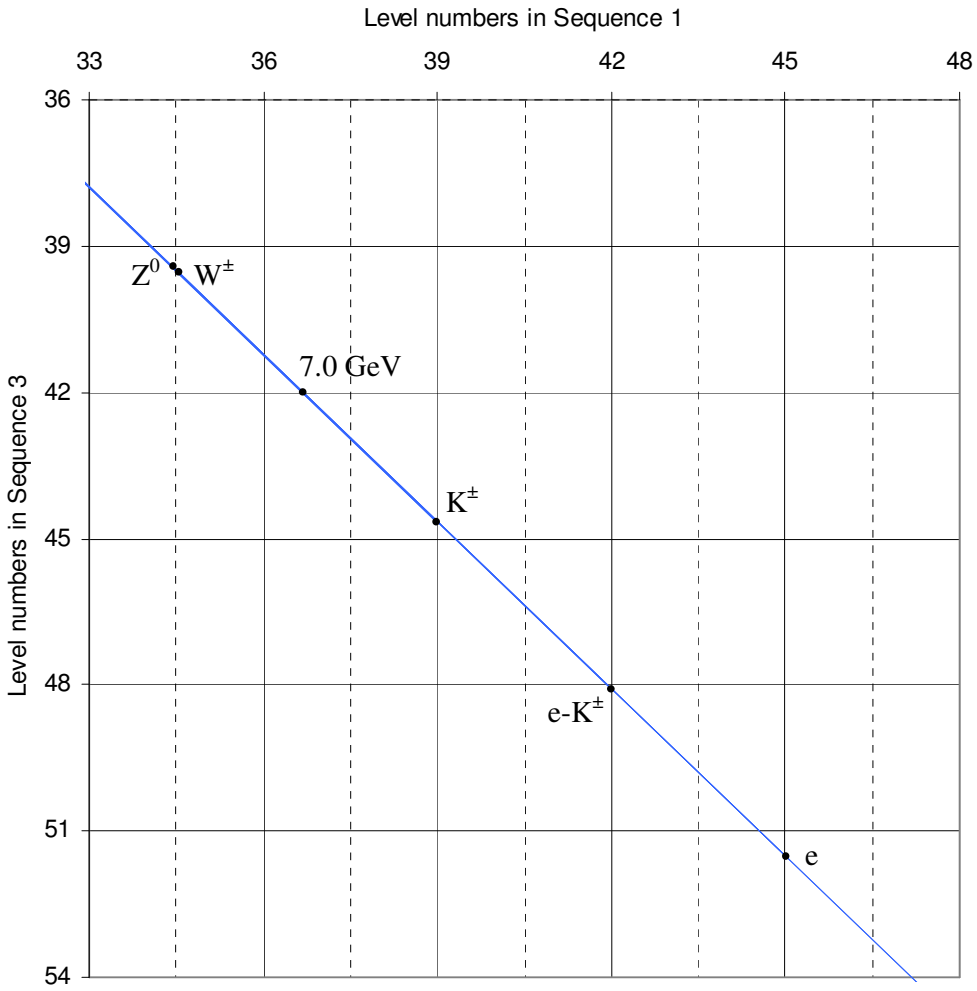

Figure 2: Superlevel occupation in Sequences 1 and 3

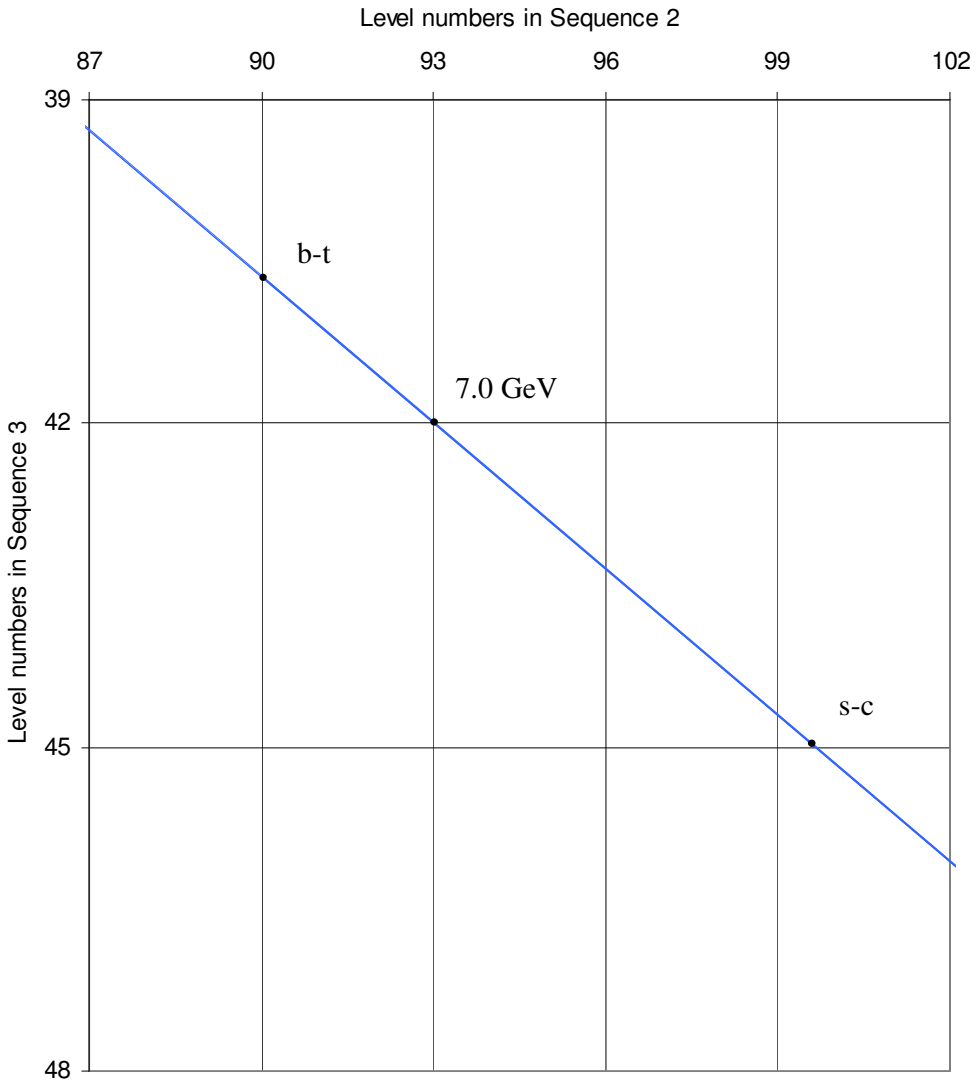

Figure 3: Superlevel occupation in Sequences 2 and 3