APR17-2016-000877

Abstract for an Invited Paper
for the APR17 Meeting of
the American Physical Society

**Is there a sign of new physics in beryllium transitions?**[1]

BARTOSZ FORNAL, University of California, San Diego

A $6.8\sigma$ anomaly in the invariant mass distribution of $e^+e^-$ pairs produced via internal pair creation in $^8$Be nuclear transitions has been reported recently by Krasznahorkay et al. in Phys. Rev. Lett. 116 (2016) 042501. The data can be explained by a $\sim 17$ MeV vector gauge boson $X$ produced in the transition of an excited beryllium state to the ground state, $^8\mathrm{Be}^* \rightarrow {}^8\mathrm{Be}\, X$, followed by the decay $X \rightarrow e^+e^-$. We find that the gauge boson $X$ can be associated with a new "protophobic" fifth force (i.e. with a coupling to protons suppressed compared to its coupling to neutrons) with a characteristic range of $\sim 10$ fm and milli-charged couplings to first generation quarks and electrons. We show that such a "protophobic" gauge boson is consistent with all available experimental constraints and we discuss several ways to embed this new particle into an anomaly-free extension of the Standard Model. One of the most appealing theories of this type is a model with gauged baryon number, in which the new gauge boson kinetically mixes with the photon, and provides a portal to the dark matter sector. Apart from the phenomenological richness of the model, it can also alleviate the current $3.6\sigma$ discrepancy between the predicted and measured values of the muon's anomalous magnetic moment.

[1]B.F. acknowledges partial support from DOE Grant DE-SC0009919 and NSF Grant PHY-1316792.