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The Experimental Search for Hidden Sector Photons

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Are there more photon-like particles, and consequently additional forces, in Nature? Such particles would be U(1) vector gauge bosons, couple to some analogue of electric charge, and could be massive or massless. Recent experimental surprises in the cosmic rays, possible direct sightings of Dark Matter, and the discrepancy between the experimental and theoretical values of the muon's anomalous magnetic moment have all prompted explanations involving hidden sector photons, often with masses below 1 GeV. Holdum recognized in the '80's that if such particles exist, they would "kinetically mix" with the standard model photon, giving them an effective coupling to electric charge, albeit with strengths $1/1000^{\text{th}}$ or less compared to the normal electromagnetic coupling. So hidden sector photons aren't perfectly hidden. Since they couple to electrons, hidden sector photons could be radiated in a bremsstrahlung-like process, and, if they were heavy enough, hidden sector photons could decay to electron-positron pairs. Both their production and decay would however be highly suppressed compared to processes governed by normal electromagnetic interactions, so they may well be hidden under huge Standard Model backgrounds. This talk will discuss the physics of and motivations for hidden sector photons, and review the status and prospects of searches for them at electron and hadron collider experiments, fixed target electron beam experiments, beam dump experiments, and laser experiments. The chance to find a new force particle, at a readily accessible mass, perfectly motivates this new territory on the Intensity Frontier.