WIMPs and axions from natural supersymmetry

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Underlying motivations:

- Supersymmetric solution to gauge hierarchy problem and Higgs boson mass stability
- Axion solution to the strong CP problem
- SUSY DFSZ (Kim-Nilles) axion solution to SUSY mu problem: PQ symmetry forbids superpotential mu term but then it is generated as a consequence of PQ symmetry breaking at $\mu \sim f_a^2/m_P$
- Spectra admit a natural Little Hierarchy characterized by $\mu \sim f_a^2/m_P \sim 100-200$ GeV $\ll m_{SUSY} \sim m_{3/2} \sim 1-20$ TeV
- SUSY spectra easily accommodates LHC sparticle mass bounds and $m_h \simeq 125$ GeV

Experimental consequences:

- Expect higgsino-like WIMPs of mass $m_\chi \sim 100-200$ GeV which constitute only a portion of total dark matter abundance; axions constitute the remainder
- Higgsino-like WIMPs should be detectable by (multi) ton-scale noble liquid detectors
- SUSY DFSZ axions may occur over a range 3×10^{-7} eV $\lesssim m_a \lesssim 3\times 10^{-4}$ eV
- The DFSZ SUSY axion may have highly diminished $ga\gamma\gamma$ coupling compared to non-SUSY DFSZ due to presence of higgsinos circulating in triangle diagram; this effect may move axions back into realm of invisible to barely invisible

Conclusions:

While planned future SI WIMP searches are sufficient to test SUSY with radiatively driven naturalness, broader and deeper probes into m_a vs. $g_{a\gamma\gamma}$ axion parameter space may be required for discovery of the predicted axions. Additional funding to support such efforts is needed.