

This advanced graduate course in theoretical physics will review the roots of the Standard Model of Particle Physics and motivate directions to go beyond this minimal structure. It will include a selection of theory topics from Supersymmetry, Extra Dimensions, Particle Compositeness, Twin Higgs, Flavor Physics, Axions, Cosmic Inflation, Dark Matter, Dark Energy, and the Matter-Antimatter Asymmetry. It will also survey related experimental directions. The hope is to not just provide familiarity with existing theories, but to develop the instinct and taste for model-building new ones, and to provide a number of tricks of the trade that are hard to find in print.

The prerequisite is a knowledge of Quantum Field Theory and Gauge theory at the level of Peskin and Schroeder's textbook. A knowledge of General Relativity would also be useful. Course requirements will be discussed at the beginning of classes, but will include student seminars on a selection of topics.

I will be making up my own lectures, but here are some references that give some flavor of the material to be presented:

My GGI lectures on youtube

<https://www.youtube.com/watch?v=gvBY7b4kCck&list=PLDxsZU4NC6Z5xji9-WyPm5uTyfYCV-pK7>

Tasi 2004 lectures: To the fifth dimension and back

Raman Sundrum (Johns Hopkins U.). Aug 2005. 49 pp.

Lectures given at Conference: [C05-06-05.2](#), p.585-630, Lectures given at Conference: [C04-06-06.1](#), p.585-630
e-Print: [hep-th/0508134](#) | [PDF](#)

Supersymmetry phenomenology (with a broad brush)

Michael Dine (UC, Santa Cruz). Dec 1996. 67 pp.

SCIPP-96-73

Conference: [C96-06-02](#), p.813-881 [Proceedings](#)

e-Print: [hep-ph/9612389](#) | [PDF](#)

Baryogenesis for weakly interacting massive particles

Yanou Cui, Raman Sundrum (Maryland U.). Dec 2012. 5 pp.

Published in **Phys.Rev. D87 (2013) no.11, 116013**

UMD-PP-012-024

DOI: [10.1103/PhysRevD.87.116013](https://doi.org/10.1103/PhysRevD.87.116013)

e-Print: [arXiv:1212.2973 \[hep-ph\]](#) | [PDF](#)

Natural Inflation and Quantum Gravity

Anton de la Fuente (Maryland U.), Prashant Saraswat (Maryland U. & Johns Hopkins U.), Raman Sundrum (Maryland U.). Dec 10, 2014. 6 pp.

Published in **Phys.Rev.Lett. 114 (2015) no.15, 151303**

UMD-PP-014-023

DOI: [10.1103/PhysRevLett.114.151303](https://doi.org/10.1103/PhysRevLett.114.151303)

e-Print: [arXiv:1412.3457 \[hep-th\]](#) | [PDF](#)