

**WEEK 19: The Big-Bang Observatory, a Follow-On to LISA; and
GW Detection in the ELF Band Using the CMB Polarization**

Lecture 35 Part 1 by William M. Folkner (JPL) [Big Bang Observatory]

Lecture 35 Part 2 by Mark Kamionkowski (Caltech) [GW Detection via CMB Polarization]

Reading Related to These Lectures:

Items in bold are recommended; others are supplementary.

Big-Bang Observatory

1. References on the background waves from white-dwarf binaries:

- (a) D. Hils and P. Bender, *Classical and Quantum Gravity*, **14**, 1439–1444 (1997).
- (b) R.F. Webbink and Z. Han, in *Laser Interferometer Space Antenna*, Proceedings of the Second International LISA Symposium, AIP Conference Proceedings, ed. W.M. Folkner (American Institute of Physics, Woodbury, NY, 1998), pp. 61ff.

2. As yet there are no written documents on the Big Bang Observatory, but it will be discussed in a **forthcoming report of the Roadmap Team of NASA’s Structure and Evolution of the Universe Subcommittee (SEUS)**, which is chaired by E. Sterl Phinney; see <http://universe.gsfc.nasa.gov/roadmap.html> .

GW Detection via CMB Polarization

- 3. For a pedagogical overview of the cosmic microwave background and its use to search for gravitational waves from the inflationary era of the universe, see M. Kamionkowski and A. Kosowsky, “The Cosmic Microwave Background and Particle Physics,” *Annual Reviews of Nuclear and Particle Science*, **49**, 77–123 (1999); also available at <http://xxx.lanl.gov/abs/astro-ph/9904108>; **especially Section 4.2 “Temperature and Polarization”, and Section 4.4 “Polarization and Gravitational Waves”**.
- 4. For a recent summary of prospects to detect inflationary gravitational waves via the CMB polarization, what we may learn from such detection, and the issues involved in achieving such detection, see
 - (a) **M. Kesden, A. Kooray, and M. Kamionkowski, “Separation of Gravitational-Wave and Cosmic-Shear Contributions to Cosmic Microwave Background Polarization,” *Physical Review Letters*, **89**, 011304 (2002); also available at <http://xxx.lanl.gov/abs/astro-ph/0202434>;**

- (b) L. Knox and Y.-S. Song, “A limit on the Detectability of the Energy Scale of Inflation,” *Physical Review Letters*, **89**, 011303 (2002); also available at <http://xxx.lanl.gov/abs/astro-ph/0202286>.
5. For the detailed theory underlying the use of the CMB polarization to detect primordial gravitational waves, see
- (a) M. Kamionkowski, A. Kosowsky and A. Stebbins, “Statistics of Cosmic Microwave Background Polarization”, *Physical Review D*, **55**, 7368–7388 (1997); also available at <http://xxx.lanl.gov/abs/astro-ph/9611125> .
 - (b) M. Kamionkowski and A. Kosowsky, “Detectability of Inflationary Gravitational Waves with Microwave Background Polarization”, *Physical Review D*, **57**, 685–691 (1998); also available at <http://xxx.lanl.gov/abs/astro-ph/9705219>.