FUTURE GROUND-BASED FACILITIES FOR RESEARCH IN HELIOPHYSICS AND SPACE WEATHER OBSERVATIONS. A. A. Pevtsov[1], V. Martinez-Pillet[1], H. Gilbert[2], A. G. de Wijn[2], M. Roth[3], and ngGONG team, [1]National Solar Observatory 3665 Discovery Drive, 3rd Floor Boulder, CO 80303, apevtsov@nso.edu, [2]High Altitude Observatory, P.O. Box 3000, Boulder, Colorado 80307-3000, [3]Leibniz-Institut für Sonnenphysik (KIS), Schöneckstr. 6, 79104 Freiburg, Germany.

Background and Future Directions:

The NSO Integrated Synoptic Program (NISP) currently operates the Global Oscillations Network Group (GONG) – a global network of six stations, which provide nearly continuous observations of the Sun for scientific research in solar magnetism and the solar interior. It also provides observations for operational space weather forecasting. GONG was in operations since 1995 and is aging rapidly. To replace it, we propose to design a next generation Ground-based solar Observing Network (provisionally named ngGONG). This facility will enable fundamental research in solar and space physics, solar-stellar astrophysics, and modeling of geospace and space weather.

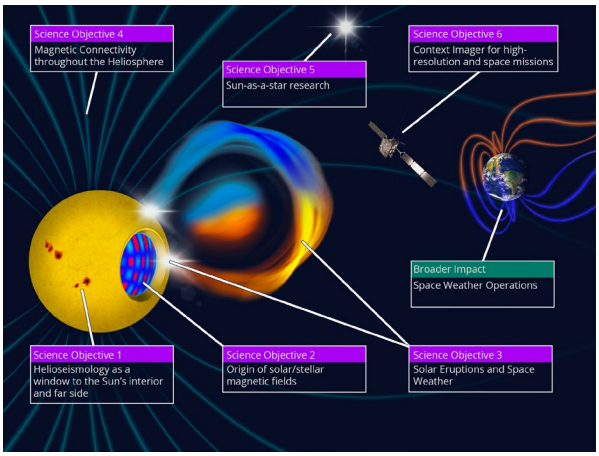

Figure 1: Graphical summary of ngGONG science objectives.

To achieve its science objectives (Figure 1), ngGONG will take observations of Doppler velocities in the photosphere, high cadence imaging data, vector magnetic fields in the photosphere and chromosphere, full-disk spectrally resolved scans of polarized light for Doppler velocity and magnetic field diagnostics of the photosphere and chromosphere, coronal white light and spectropolarimetric observations, and Sun-as-a-star spectra. The design of ngGONG is driven by the research interests of the national and international solar and solar-stellar scientific communities, informed by the requirements of space-weather forecasting agencies, and motivated by the need to protect the nation's critical infrastructure. In particular, strong links exist between ngGONG and the European SPRING (Solar Physics Research Integrated Network Group).

The ngGONG will consist of several geographically-distributed stations located at international sites with longitudes, weather patterns, and technical expertise selected to provide nearly continuous observations of the Sun for many years. ngGONG instruments will include: spectropolarimeters for the precise measurements of solar magnetic fields at multiple heights; coronagraphs capable of monitoring the violent ejecta of magnetized plasma from the Sun's atmosphere and determining coronal magnetic topologies and plasma properties; and instruments for Doppler velocity measurements required for studies of helioseismology. Once operational, ngGONG will:

- Provide key infrastructure for measurements of the processes that drive the solar atmosphere and space weather throughout the heliosphere;
- Provide quantitative context for high resolution solar and in-situ measurements and models;
- Bridge solar and stellar research in the area of stellar activity and its consequences for habitability on planets around other stars;
- Enable discoveries by building a multi-decade record of solar variability to be exploited by future generations of scientists.
- Provide near real time observations for operational space weather forecast.

ngGONG will collect critical observations of solar activity and the Sun's magnetic field over two solar magnetic cycles. The interplay between the subphotospheric flows and the magnetic fields is at the core of understanding the nature of the magnetic activity on the Sun and other stars. The connections among the solar surface to the corona and heliosphere are essential for understanding the fundamental processes that heat the corona, accelerate the solar wind, and drive space weather. These observations also form the basis for advancing the modeling of space weather effects on modern technologies. ngGONG will provide data in support of solar and stellar astrophysics (Sun-as-a-star research), magnetospheric physics, atmospheric chemistry, and planetary habitability. Finally, the project will pave the way to future discoveries by collecting observational data that can be leveraged by the next-generation of researchers.