

**[☞IGRINS-13] Cryogenic Thermal Cycling Test on IGRINS
cross-disperser VPH Grating**

Hyeonju Jeong^{1,3}, Juhee Lim³, Sunghoo Lee², Casey Deen¹,
Soojong Pak³, In-Soo Yuk^{1,2} and Daniel T. Jaffe^{1,3}

¹ *Department of Astronomy, The University of Texas, Austin, TX, USA*

² *Korea Astronomy and Space Science Institute, Daejeon, South Korea*

³ *School of Space Research, KyungHee University, Suwon, South Korea*

VPH (Volume Phase Hologram) grating is one of the transmission gratings and is known as its remarkable efficiency (>90%). It has two different densities of gelatins causing interference patterns. The VPH grating is favored in many astronomical instruments these days and also IGRINS, which is up coming near infrared high-resolution spectroscopy expected to see the first light next year, uses the VPH grating as its cross-disperser. The infrared astronomical instruments operate at cryogenic temperature (~100K) in order to cut down thermal noise and the optical components of IGRINS will be operated at 130K. The VPH grating is sandwiched in between fused silica or glass and glued together using optical adhesive. IGRINS is expected to go through 50 times of thermal cycling in 10 years including the performance test and this research is to check whether the physical characteristic such as the adhesion or dichromatic gelatin does not break and change from the several cryogenic thermal cycling. The two identical test gratings provided from Kaiser Optical System, Inc. are used in this test. One VPH grating is cooled down to 100K for 2 hours with maximum $dT/dt = 5$ and warmed up to the room temperature and another grating is kept stored in the room temperature and used as a control sample. In order to check the change, we inspected the grating with eyes and checked its efficiency and transmission at the room temperature every 10 cycling. From the 40 times of cryogenic temperature cool down cycling, the VPH grating showed no signs of change within the error compared to the control sample. We concluded the VPH grating is durable through several cryogenic thermal cycling.
