Low-contrast pre-coronagraph for extra contrast of dark-hole

Jun Nishikawa¹,2,3 Masahito Oya⁴,¹ Naoshi Murakami⁵
Motohide Tamura⁶,¹,³ Takashi Kurokawa¹,⁷ Yosuke Tanaka⁷ and Takayuki Kotani³,¹

¹National Astronomical Observatory of Japan, Extrasolar Planet Detection Project Office,
2-21-1 Osawa, Mitaka, Tokyo, Japan, 181-8588
e-mail: jun.nishikawa@nao.ac.jp
²SOKENDAI (Graduate University for Advanced Studies), Faculty of Physical Sciences,
2-21-1 Osawa, Mitaka, Tokyo, Japan, 181-8588
³National Institute of Natural Sciences, Astrobiology Center,
2-21-1 Osawa, Mitaka, Tokyo, Japan, 181-8588
⁴Nihon University, Graduate School of Physics,
Surugadai 1-8-14, Chiyoda, Tokyo, Japan, 101-8308
⁵Hokkaido University, Faculty of Engineering,
Kita 13 Nishi 8, Kita-Ku, Sapporo, Hokkaido, Japan, 060-8628
⁶The University of Tokyo, Graduate School of Science, Department of Astronomy,
7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan, 113-0033
⁷Tokyo University of Agriculture and Technology, Graduate School of Engineering,
Koganei, Tokyo, Japan, 184-8588

Abstract. We propose a low-contrast pre-coronagraph that can provide additional dark-hole contrast to a main coronagraph.

Keywords. instrumentation: adaptive optics, techniques: interferometric.

1. Pre-coronagraph under dark-hole control

The low-contrast pre-coronagraph (LPC) is a new style of the unbalanced nulling interferometer (UNI) which was developed for precise wavefront control (Nishikawa et al. 2008). The LPC is used in the four-stage coronagraph system: the first deformable mirror (DM), the LPC, the second DM, and the main coronagraph, to obtain an additional contrast to the main coronagraph. Originally a wavefront sensor was used around the UNI (LPC) and we characterized it using a four-quadrant phase mask coronagraph (Kobayashi, et al. 2012). Recently we have found that the two deformable mirrors in the system can be controlled by the dark-hole algorithm with a final focal-plane detector if we use two steps. First, the control is made by the first DM with a normal mask at the pre-coronagraph and without a mask at the main coronagraph. Second, the control is made by both two DMs to produce the circular dark hole with a low-contrast mask exchanged at the pre-coronagraph and with a normal mask at the main coronagraph.

References


Downloaded from https://www.cambridge.org/core. IP address: 54.70.40.11, on 24 Jan 2019 at 07:06:35, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/S1743921316002854