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

Jun Nishikawa\textsuperscript{1,2,3}, Masahito Oya\textsuperscript{4,1}, Naoshi Murakami\textsuperscript{5}, Motohide Tamura\textsuperscript{6,1,3}, Takashi Kurokawa\textsuperscript{1,7}, Yosuke Tanaka\textsuperscript{7} and Takayuki Kotani\textsuperscript{3,1}

\textsuperscript{1}National 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
\textsuperscript{2}SOKENDAI (Graduate University for Advanced Studies), Faculty of Physical Sciences, 2-21-1 Osawa, Mitaka, Tokyo, Japan, 181-8588
\textsuperscript{3}National Institute of Natural Sciences, Astrobiology Center, 2-21-1 Osawa, Mitaka, Tokyo, Japan, 181-8588
\textsuperscript{4}Nihon University, Graduate School of Physics, Surugadai 1-8-14, Chiyoda, Tokyo, Japan, 101-8308
\textsuperscript{5}Hokkaido University, Faculty of Engineering, Kita 13 Nishi 8, Kita-Ku, Sapporo, Hokkaido, Japan, 060-8628
\textsuperscript{6}The University of Tokyo, Graduate School of Science, Department of Astronomy, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan, 113-0033
\textsuperscript{7}Tokyo 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.

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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 \textit{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, \textit{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