The bright-star masks for the HSC-SSP survey

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Abstract

Key words: xxxx: xxxx — ......

1 Introduction

The high sensitivity of the Hyper-Suprime-Cam is such that on a typical exposure of a few minutes, point-source objects brighter than $\sim 17-19$th magnitude saturate and affect nearby sources. Ideally one would like to directly rely on our catalogue to identify and mask bright stars[1], however, if the pipeline can identify large saturated areas, it is difficult (although not impossible) to precisely measure the required size of masks due to the photometric artefacts caused by the bright stars. To ease the process, we therefore make use of external data.

A first version of the bright-object masks has been made by Jean Coupon and Nicole Czakon for the S15B and S16A internal data releases, but this version was over conservative in the choice of mask radius and contained about 10% of bright galaxies, making it non ideal for a number of science cases. The goal here is to update the masks to a much cleaner version (i.e. truly a bright-*star* mask).

In this document we describe the procedure we adopt to automatically construct and validate the bright-star masks for the HSC-SSP broad-band filters $grizY$, using data from the Gaia, Tycho-2, and SDSS surveys. We limit ourselves to the sample of bright stars that saturate on HSC-SSP images (the information on non-saturated stars – such as brightness and PSF-size – can be easily gathered HSC-SSP data), that is as complete as possible, and 100% pure (to avoid masking bright galaxies).

[1] Here, other bright point sources, such as QSOs, are included in the term *bright stars*.

We first describe the problem in Section 2, we then describe how we gather a sample of bright stars in Section **??** and how we construct the masks in Section **??**. In a last Section **??** we estimate the purity and completeness of the bright stars masks, quantify the improvement on a number of observables, and describe their limitations. We conclude in Section **??**.

2 Saturated stars in HSC

2.1 Overview

The brighter-fatter effect, the diffraction, and electron leaking to nearby pixels, result in (1) isotropic luminous haloes, (2) anisotropic spikes, and (3) unidirectional "bleed trails", as shown in Figure **??**. The extent of the saturated stars on the image increases with brightness and therefore impact the neighbouring sources through the degradation of the detection performance and the measurements reliability, as well as screening background sources. Here we aim to record the position of such bright stars and to construct photometric masks to reject those unreliable sources.

See Fig1

3 Section2

In figure **??**, ...

4 Section 3

In the theory (Aauthor et al. 2001)..........

4.1 Subsection

In the theory (Aauthor & Bauthor 2003a)..........

4.1.1 Subsubsection

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Table 1. This is the first tabular.

Name	Value1	Value2	
aaa	bbb	ccc	ddd
eee	fff	ggg	hhh
....			

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Table 2. Sample of "longtable."

Name	Value1	Value2	Value3
aaaaa	bbbbb	ccccc	ddddd
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......	.....	.....	.....
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wwwww	xxxxx	yyyyy	zzzzz

5 Section 4

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Acknowledgments

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Appendix 2 Case of two or paragraphs

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