The use of Photometric Techniques in Teaching Science Projects

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TELESCÓPIOS na ESCOLA

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INTRODUCTION

- **Hands-on activities based on astronomical images have been offered by the Educational Project *Telescópios na Escola* (TnE - Telescopes in School).**

- **These activities are largely used by undergraduate students and in teachers training.**
- **However, when tested by students of secondary school, it is noted that tutorials of the adopted software use too complicate technical terms.**

Research Project in High School

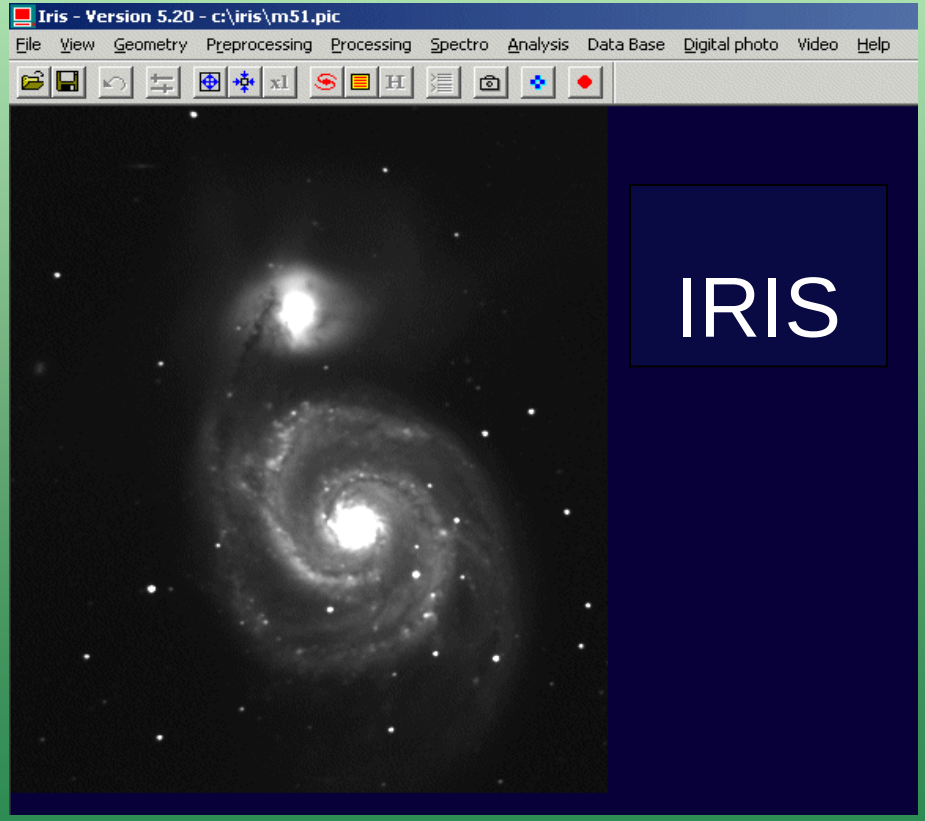
- The University of São Paulo created a project that allows students of High School to take part on scientific research.

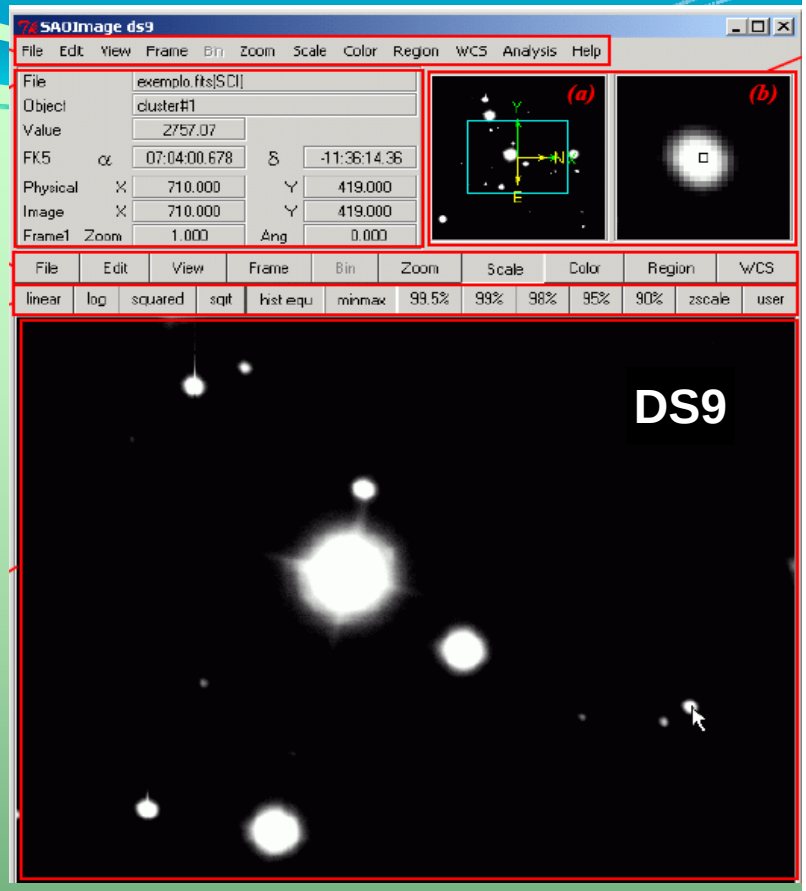
Our group choose to study images of a stellar cluster obtained in different nights and filters, aiming to use photometric techniques to derive magnitudes and colours of the stars.

Tools for Processing the Astronomical Images

- Most of the classroom activities were based on tools available in DS9, for which an User's Manual was previously organized to be used by undergraduate students..
- The adopted DS9's manual was revised by the High School students, aiming to provide a simplified version, in a more accessible language.
- The students have tested and compared DS9 with different software, like IRIS, SalsaJ, and PInE.
- In this work we present the results of this comparison, that has been used to improve PInE, a software to process images in the TnE project.

Adapting Photometric Techniques





- Different software were used, according to the proposed classroom activity.

Students report about image processing

- **DS9** provides several facilities and interesting tools for image visualization.

- *Photometric measurements and background sky extraction are not automatic and require the use of worksheets.*
- *It can be useful in the learning process of the methodology, but it is annoying when we need to measure numerous objects.*

Description of the classroom activity

Medição de Brilho das Estrelas

Técnicas fotométricas

Eduardo Brescansin de Amôres, Raquel Yumi Shida, Sergio Scarano Jr.

1. INTRODUÇÃO

O que aprenderei nesta atividade?

Você aprend

imagens obtid

A seguir, es

Quando voc

que viajou gra

primeiros 99.9

mesmo atravé

diferença no b

Fotometria

fotometria par

botão principal sobre a região inserida e, na caixa de diálogo *Box*, ajuste o tamanho horizontal e vertical para *9 píxeis* no campo *Size* e atribua um novo nome à região preenchendo o campo *Text*. Ajuste o posicionamento do quadrado sobre a imagem da estrela da mesma forma como foi feito na atividade sobre as luas de Júpiter.

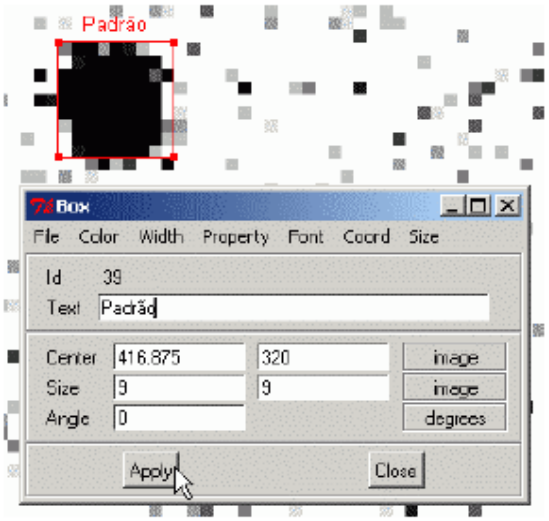


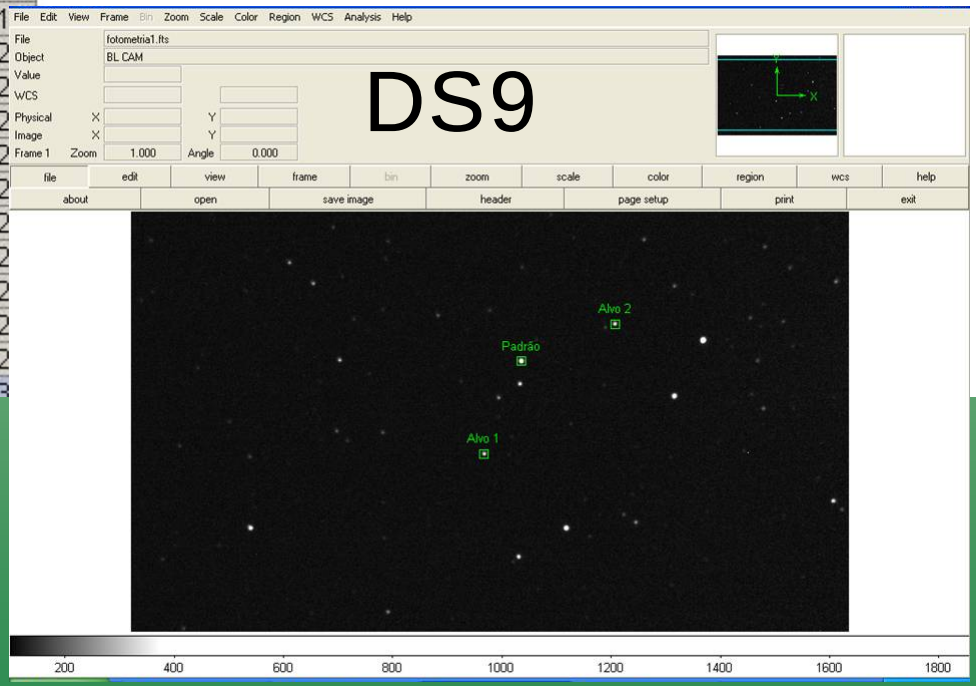
Figura 3: Inserindo e ajustando as configurações de uma região quadrada sobre a imagem.

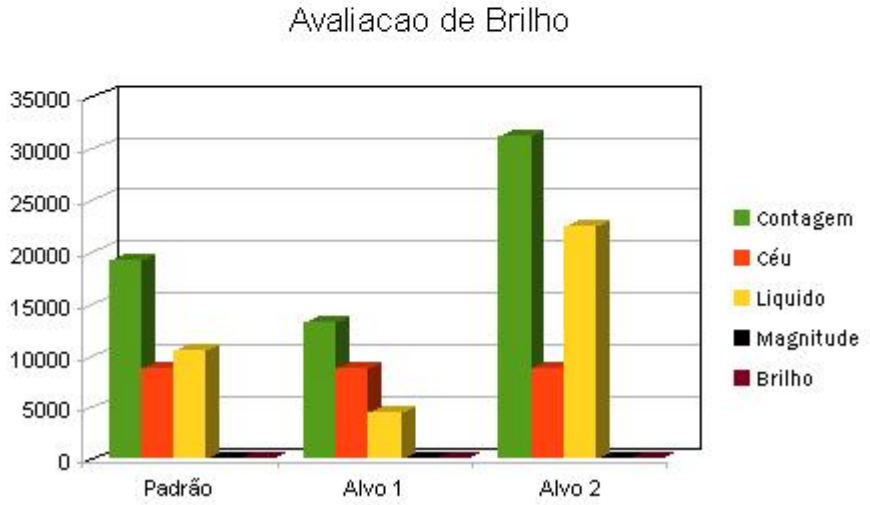
Tutorial using DS9 in photometric measurements

	Padrão B								
	370	371	372	373	374	375	376	377	378
279	108	124	135	148	177	184	156	142	122
278	105	124	138	219	267	293	241	180	140
277	118	133	188	311	502	489	388	239	156
276	109	131	206	404	731	855	642	305	161
275	114	125	204	428	778	1001	691	317	172
274	111	133	170	311	503	561	412	216	151
273	115	128	139	169	232	237	212	149	129
272	107	112	121	133	154	150	136	125	115
271	113	110	111	110	122	108	127	119	108
Total	1000	1120	1412	2233	3466	3878	3005	1792	1254
Total Final	19160								

	Avaliação de Brilho				
	Contagem	Céu	Liquido	Magnitude	Brilho
Padrão	19160	8699	10461	12,4	1,91x10-14
Alvo 1	13150	8699	4451	12,8	1,32x10-14
Alvo 2	31159	8699	22460	11,9	3,02x10-14

	contagem	céu	contagem/céu
Padrão	19160	8699	2,202552017
Alvo 1	13150	8699	1,511668008
Alvo 2	31159	8699	3,581905966

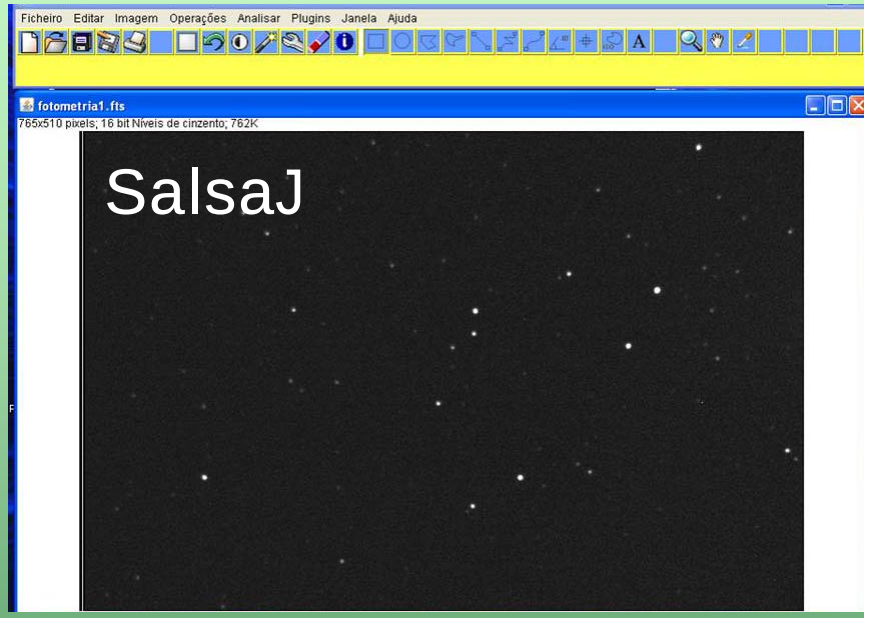




Photometry using DS9

Comparing DS9 with Salsa J

- **Salsa J** has the advantage of having a version translated to the Portuguese language.
- The buttons are illustrated by figures representing the tools, which makes easy the use by beginners.



- The weakness, when compared to **DS9,** is the smaller number of tools, being not adequate for some of the activities.
- Intermediate results cannot be saved.

Tne & GHOU

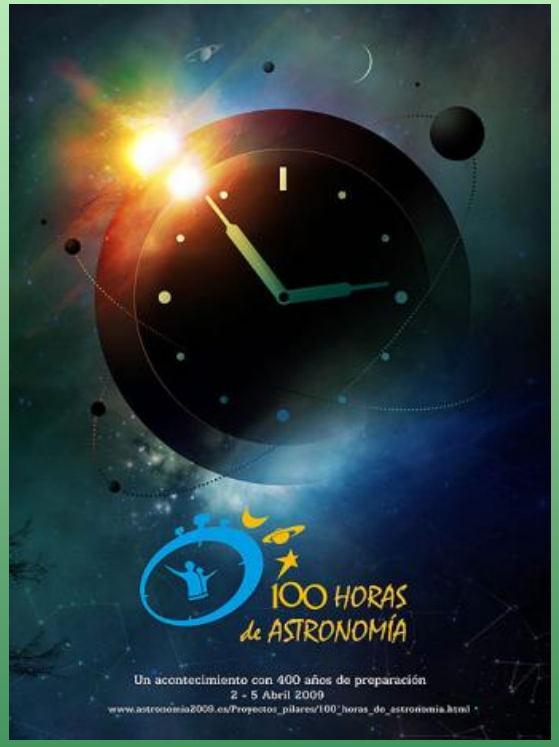
Brazil & Portugal Videoconference

- In collaboration with *Global Hands on Universe* group in Portugal, our students could discuss with teachers and researchers* that lead the same kind of projects developed by us.

- They talked about their project, differences in local time and the appearence of the Moon, during a videcon in December 5th, 2008.

(*) NUCLIO Núcleo Interactivo de Astronomia

TnE in the “100 hours of Astronomy”



- A second videoconference, was organized by TnE and the NUCLIO Portuguese group, on April 4th, during the event “100 hours of Astronomy”.
- Our students watched a conference on “Galileo’s Telescope in Portugal”, by Henrique Leitão (CIUHCT, Universidade de Lisboa).
- A direct view of the Moon in the Northern Sky, could also be observed via skype.

Summary

- We presented a comparison of different image processors, based on the report from the students.
- Different techniques for measuring flux and subtracting background sky contribution could be tested. The reports from the students have allowed us to improve a new software under development, PInE (Processamento de Imagens na Escola – image processing ins School) .
- The students considered difficult the technical terms in the adopted tutorials, which are often used by undergraduate students. The texts will be revised according to their suggestion.
- Our group experienced to work in collaboration with an European group, a first step to involve students from Brazil and Portugal in future research projects related to science teaching.