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G.Pietrzynski (UConcepcion), and sponsored  
by the FONDAP Center for Astrophysics,  
European Southern Observatory, Princeton/  
Catolica Universities, Fundacion Andes,  
SOCHIAS, and NRAO, the goal of this  
series of Schools (http://www.astro.puc.cl/  
~school/) is to train the young generation of  
astronomers on different topics. The School  
format has been chosen in order to allow a  
deep approach of the selected themes, as  
well as to maximize exchanges between the  
invited lecturers and the attendees.  

For this School on Extrasolar Planets  
and Brown Dwarfs, held in Santiago on 15-  
19 December 2003, the four main lecturers  
were (see photo): Jill Knapp (UPrinceton),  
Michel Mayor (UGenève), France Allard  
(ENS Lyon), and Scott Tremaine  
(UPrinceton).  

Since the mid-90s, the field of brown  
dwarfs and extrasolar planets has bloomed in  
a spectacular fashion, both on the observa-  
tional side and on the modeling side. Rather  
than report on all the advances beautifully  
presented at the School, let us examine some  
of the points which remain in the to-do lists  
shown by the different lecturers.  

First of all, we shall stick, for the time  
being, to the definition adopted by the IAU:  
• “star”: mass above 80 M_{Jup} H-burning  
core  
• “brown dwarf”: mass between 80 and  
13 M_{Jup}, D burning core, large variation of  
the surface temperature from an M dwarf  
(3,000 K), to a T dwarf(< 1,300 K)  
• “planet”: mass less than 13 M_{Jup}  
One notices that this definition is not  
linked to the object formation scenario.  

The number of objects known so far are:  
about 120 planets (at distances up to 30 pc)  
and about 400 brown dwarfs (at distances up  
to 200 pc).  

On the front of observing:  
• Brown dwarfs: Jill Knapp and other  
contributors at the School reported that it is  
a “tough job” to find them (intrinsic lumi-  
nosity less than 2 \times 10^{-6} solar luminosity and  
(V-K) ~ 10). Exploiting the all-sky surveys  
available today, more than one million  
objects have been searched for: only 60 L  
dwarfs have been found... Good progress  
have been made in the M/L/T brown dwarf  
classification (on the basis of their spectra).  

To-do list: increase the sample of  
brown dwarfs, to test models, make a proper motion sur-  
vey in the NIR, formation sce-  
cnario: ascertain the low mass  
end of the stellar IMF, the rela-  
tion planets = brown dwarfs?  

• Extrasolar planets:  
Michel Mayor and other con-  
tributors reported that it is as  
well a “tough job” to find planets  
(light contrast star/planet around 10^{10}, request for 1 m/s  
velocity precision). Radial  
velocity searches have so far  
provided all known planets (~120), except  
for one. About 2000 stars in the solar vicini-  
ty are currently monitored (at distances less  
than 30 pc). Among the 120 known planets,  
10 are multiple planet systems.  

The use of other methods for planet dis-  
cover, such as transit, reflected light, micro-  
lening, etc... is in progress.  
To-do list: understand the amazing depend-  
ence on the metallicity of the parent star,  
investigate the brown dwarf desert and  
investigate its implications on the formation  
scenarii, increase the sample of known plan-  
ets up to 10^4, so that statistical properties can  
be derived with some confidence: at the cur-  
rent rate of planet discovery (about 10/year),  
this will take 10^5 years!! Can we wait that  
long?  

It was also extremely interesting to hear  
about intrinsic limitations in planet searches:  
acoustic modes of the parent stars, spots of  
the parent stars, and in the case of multiple  
planet systems, the difficulty in finding a  
unique solution in the decomposition of the  
radiation velocity curve.  

• Of course, a wealth of groundbased  
and space tools for discovering planets and  
brown dwarfs were discussed (incomplete  
list!): HARPS (1m/s precision), optical and  
NIR interferometry, adaptive optics -in the  
future multi-conjugate adaptive optics,  
COROT, KEPLER, ALMA for protoplanet-  
ary discs, SIM, GAIA, GEST, OWL and  
ELTs in general.  

On the front of modeling:  
• The atmospheres of brown dwarfs  
were extensively discussed by France  
Allard. They are rather well understood and  
modeled (thanks, among other factors, to the  
tremendous increase in computational  
power).  
To-do list: improve the opacities, consider  
more realistic dust grains (composition, shape)  

• Dynamics, kinematics, formation sce-  
narii: a large panel of fascinating problems  
were discussed by Scott Tremaine and other  
contributors at the School.  
To-do list (a subset...): elucidate the “mys-  
tery” of the planetesimal growth from cm  
size to km size, understand the physics hid-  
den in the term “viscosity” in protoplanetary  
discs, understand the “peculiarities” of the  
Solar system: its ellipticity, the location of  
Jupiter, the origin of chondrules, formation  
scenarii: collapse versus coagulation of  
planetesimals.  

• Some other interesting questions con-  
cerning the modeling of planetary systems  
were raised: are closed-box models valid?  
Given that half the mass of the Solar system  
is in small bodies, taking into account only  
massive planets to study the dynamics of  
planetary systems might be misleading; how  
to disentangle evolution (such as planet  
migration) from intrinsic properties?; what is  
the role of star multiplicity in the formation  
of planetary systems?; which is the fraction  
of lost planets?  

In conclusion, an enlightening School,  
which took place in the grounds of the  
Observatory of Cerro Calan in the heights of  
Santiago. About 80 attendees (more than  
half of them from South America) enjoyed  
the lectures, the discussions in the shadow of  
the trees, and contributed to the friendly  
atmosphere. Finally, the School dinner at  
Casa Piedra allowed everyone to admire a  
beautiful sunset on the rio Mapocho.