

**1. Title of proposal:**

Measuring the Rotation Curve of the Elusive NGC 5963: The Adventure.

**2. Abstract:****3. Principal Investigator:** (NB: The P.I. has full responsibility for the content of this proposal!)

Name:

Institute: , SE

Postal address:

Telephone:

Fax:

E-mail:

**4. Co-investigators and affiliations:****5. If this is a PhD thesis project at a Nordic institute, please give name of student, supervisor and expected time of completion:****6. Observing period(s) requested and preferred scheduling:**

<u>Run</u>	<u>Instrument</u>	<u>Time</u>	<u>Month(s)/Date(s)</u>	<u>Moon</u>	<u>Seeing</u>	<u>Sky</u>
A	ALFOSC	XXX H	May	B		

**7. Number of nights already awarded to project:****8. Number of nights needed to complete project:****9. If your project can not be done in service mode, please justify:****10. Any other special constraints on the scheduling?**

### 11. Scientific justification for the proposal:

Dark matter was first termed in a paper from 1933 [ref] by Fritz Zwicky. He used the virial theorem to calculate the gravitational mass of the galaxies in the Coma cluster and found a discrepancy between the measured mass and their expected luminosity. He referred to this "missing mass" as "dunkle materie". Today astronomers have accumulated convincing evidence of dark matter from independent observations such as galaxy rotation curves, gravitational lensing, measurements of the cosmic microwave background, baryon acoustic oscillations, supernovae distance measurements, Lyman-alpha forest measurements of distant galaxies and in structure formation scenarios.

According to the spectacularly successful Planck mission, the dark matter part of the energy in the universe is a staggering 26.8% compared with the 4.9% of ordinary matter. Even though the consensus among scientist today is that dark matter consists of Weakly Interacting Massive Particles (WIMPs), no official detections of these elusive particles have been made and the hunt for these particles is one of the major undertakings of modern physics. In what better way to make aspiring student of astronomy more comfortable with observational instruments, than for them to "see" for themselves what the "fuss" is all about? The reproducibility of science is after all one of the fundamental pillars of science itself. By the guidance of past and present mentors we therefore propose to use the NOT telescope to measure the rotation curve of NGC 5963, fit a light+dark mass profile to the acquired data and determine the stellar/dark matter mass components of this galaxy.

**The need for a new observation and its selection:** The target in consideration, NGC 5963 is of the type Low Surface Brightness (LSB) galaxy (Romanishin, Strom & Strom 1982 ApJ 252, 77) which are usual targets for dark matter studies due to their peculiar mass to light ratio. NGC 5963 is no exception to such studies (e.g. Bosma et al. 1988, A&A 198, 100). However, the latest direct observations of NGC 5963 we could find in the literature were taken over a decade ago (Simon et al. 2004 ASPC, 327, 18), which speaks for the acquisition of newer observations. Another virtue of the selected target is that if photometric images of good enough quality of the galaxy is provided, they might give insight to its anomaly underluminous nature (Zackrisson et al. in preparation). NGC 5963 strongly deviates from the expected Tully-Fisher (TF) relation (Springob et al. 2007 ApJS, 172, 599) by being underluminous and/or having far greater non-baryonic mass than expected. Newer observations with the NOT may aid in uncovering why this is so.

**12. Scientific justification** –*continued*–

**13. Technical description of the observations.** (Please provide a self-contained case.)

**14. Requested instrument setup(s):**

<u>Run</u>	<u>Instrument</u>	<u>Mode</u>	<u>Setup</u>
	ALFOSC	Standard imaging-filters	UBVRi
	ALFOSC	Spectro-long-slit	1.0, 1.3
	ALFOSC	Spectro-long-slit	Grism#8

**15. Target list with coordinates, or intervals in R.A. and Decl. of (sample of) objects:**

Run	Name	$\alpha_{2000}$	$\delta_{2000}$	Magnitude	Diam(')	Additional Info.
A	NGC 5963	15 33 27.8	+56 33 35	B=12.70	1.52	

Remarks:

**16. Backup programme (or justification why none is needed).**

(NB: The backup programme should also take unfavourable wind conditions into account)

**17. List of observing periods, and publications from NOT observations, within the last three years.**

**18. Additional remarks not covered by the items above, if any:**