Report on Task 2, step1b.

A. Moya

- Introduction (Codes involved and procedure)
- Frequency comparison
- Asymptotic properties comparison
- Conclusions and further work

INTRODUCTION

Equilibrium model

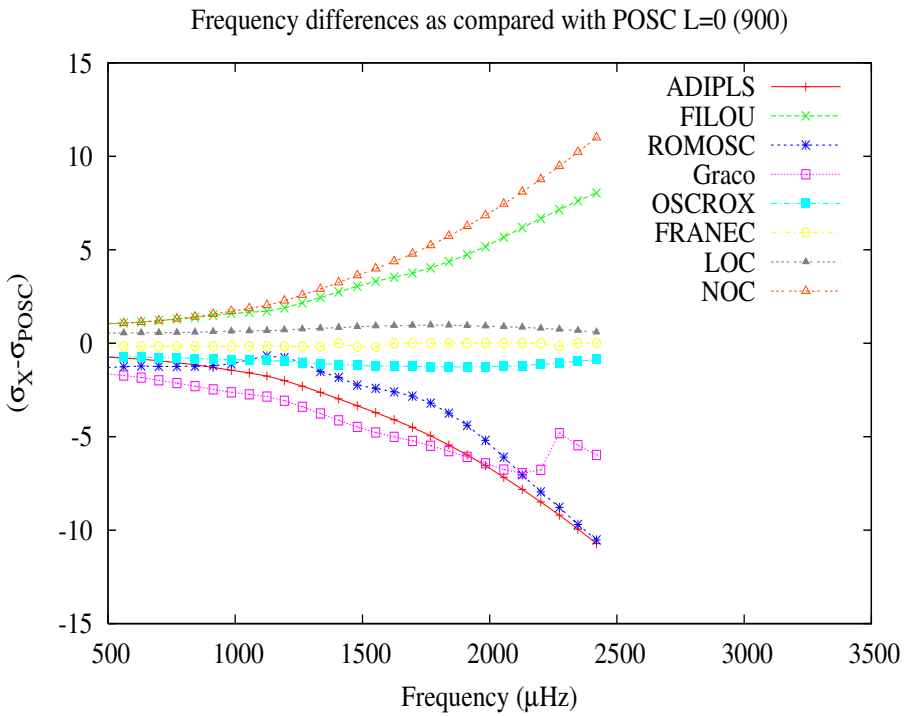
M/M_Θ	$\log T_{eff}$	$\log g$	$\log L/L_\Theta$	R/R_Θ	X_C	Age (My)	τ_{dyn} (s)
1.5	3.830	4.141	0.739	1.724	0.40	1366	2945

	ADIPLS	POSC	NOC	GraCo	FILOU
PI	J. Christensen-Dalsgaard	M. Monteiro	J. Provost	A. Moya	J.C. Suárez
	LOC	OSCROX	FRANEC	ROMOSC	
PI	R. Scufaire	I. Roxburgh	M. Marconi	M. Suran	

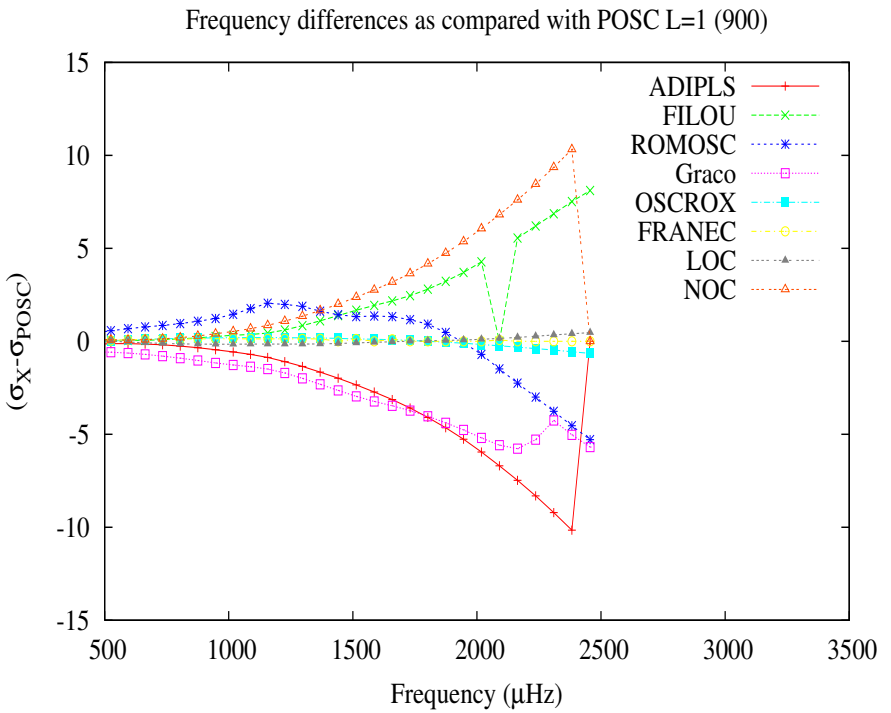
Frequency comparison

Solar-like region (900)

ℓ=0



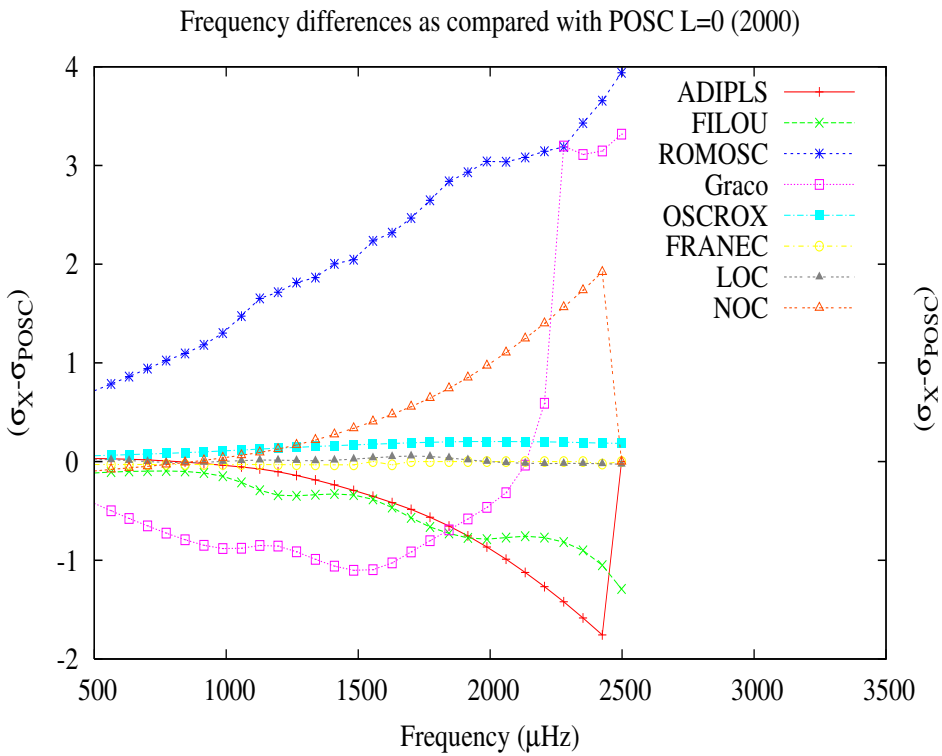
ℓ=1

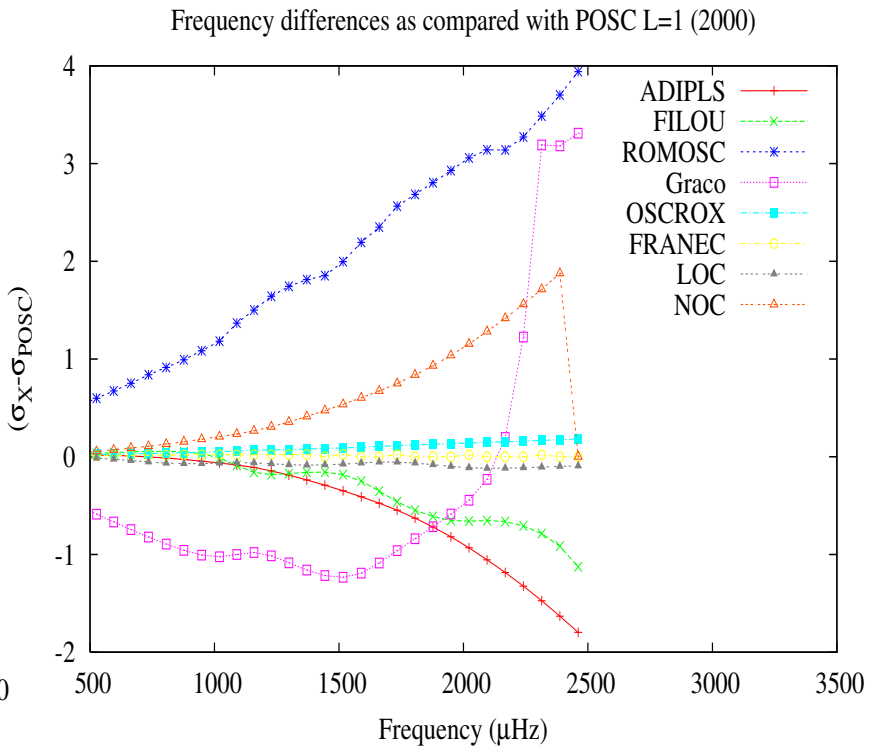


Frequency comparison

Solar-like region (2000)

ℓ=0 ℓ=1





Frequency comparison solar-like region

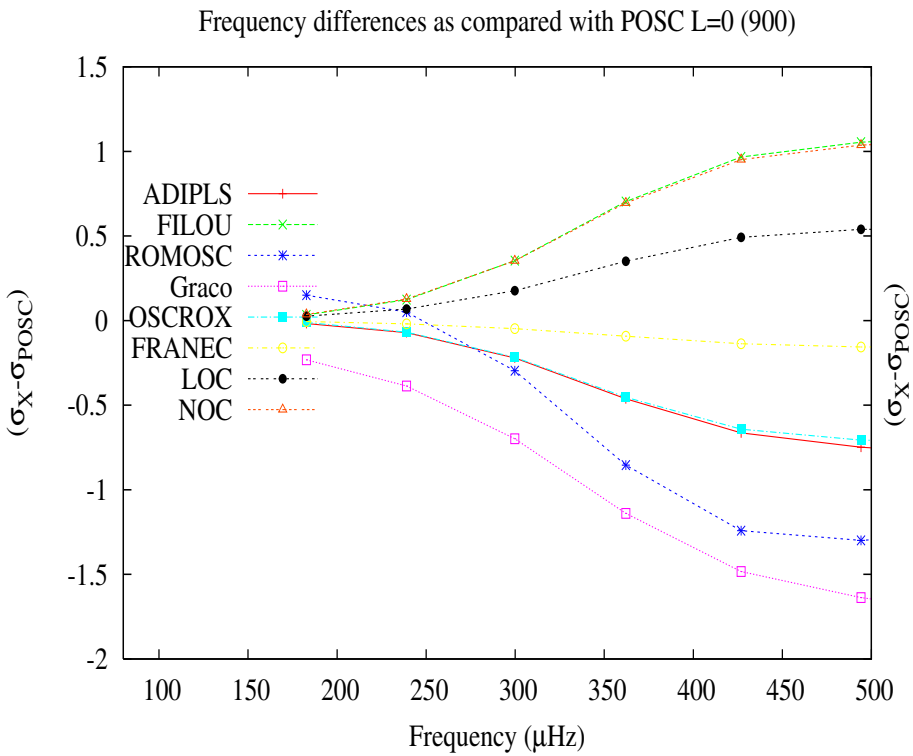
Summary of differences resp. POSC

	ℓ=0		ℓ=1	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	-1.76	0.399	-1.80	0.521
FILOU	-1.29	0.414	-1.13	0.351
GraCo	3.32	0.962	3.31	1.127
LOC	0.06	0.019	-0.12	0.075
NOC	1.92	0.456	1.88	0.622
ROMOSC	3.94	1.897	3.94	2.079
FRANEC	-0.03	0.017	-0.18	0.012
OSCROX	0.20	0.133	0.18	0.094

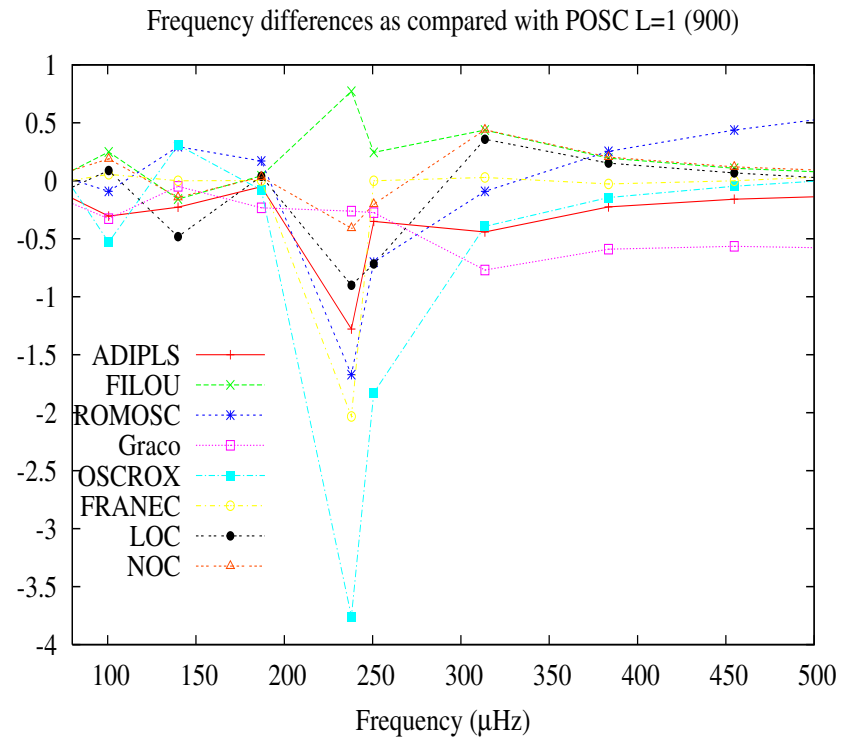
Frequency comparison

δ Scuti-like region (900)

ℓ=0



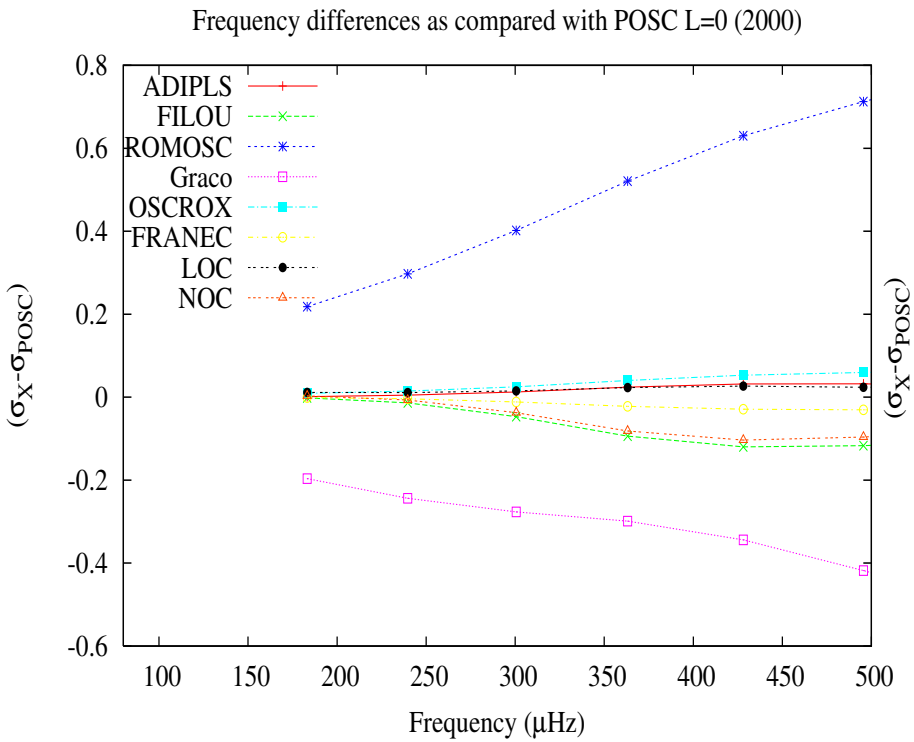
ℓ=1



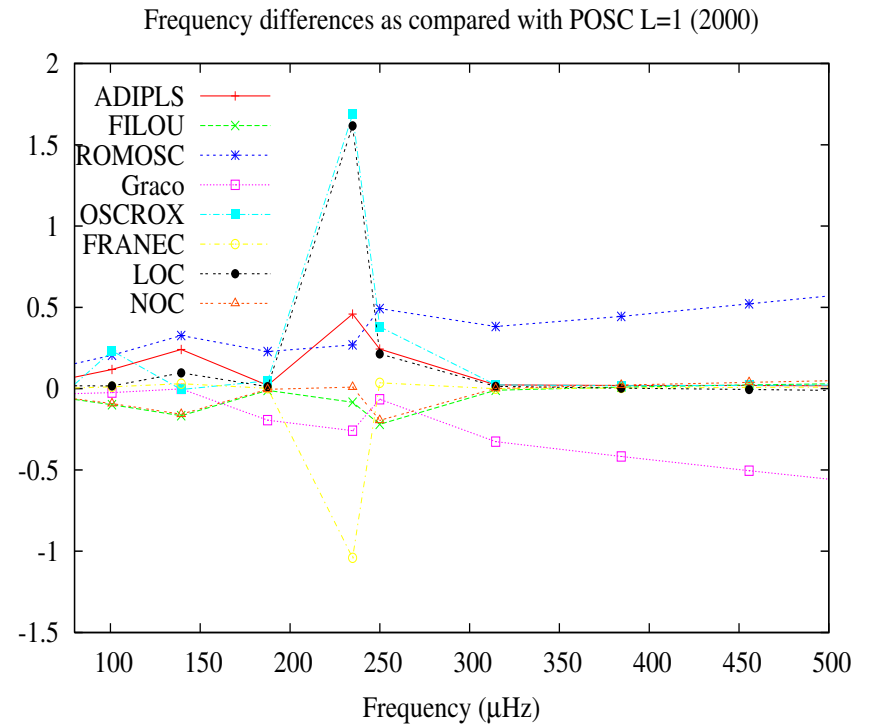
Frequency comparison

δ Scuti-like region (2000)

ℓ=0



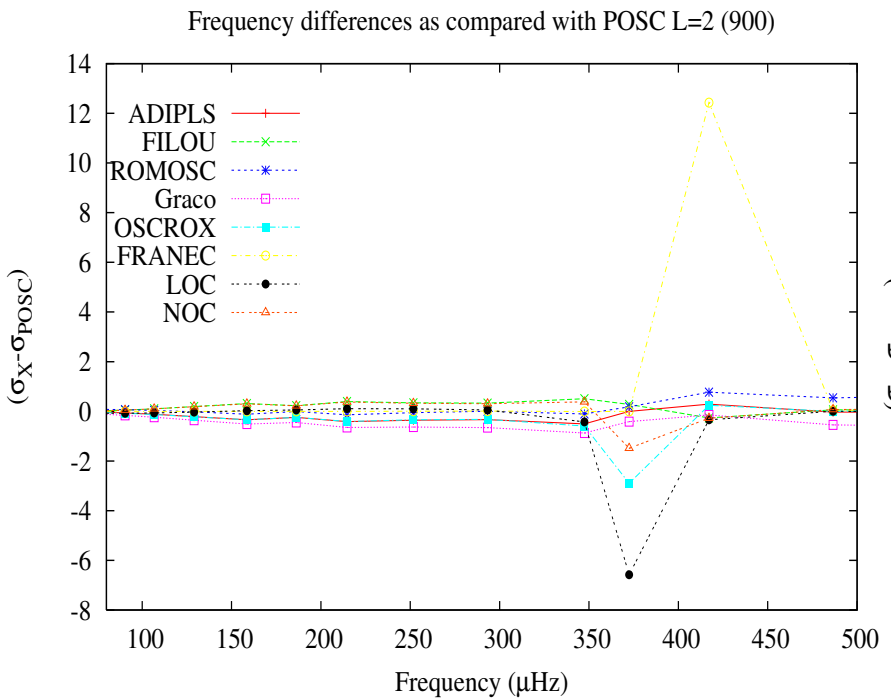
ℓ=1

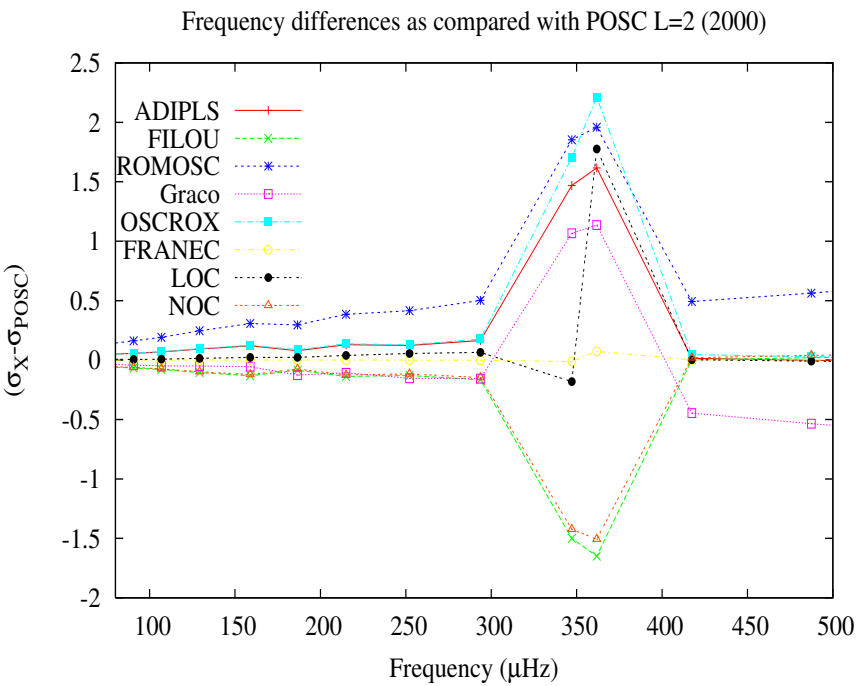


Frequency comparison

δ Scuti-like region

ℓ=2





Frequency comparison δ Scuti-like region

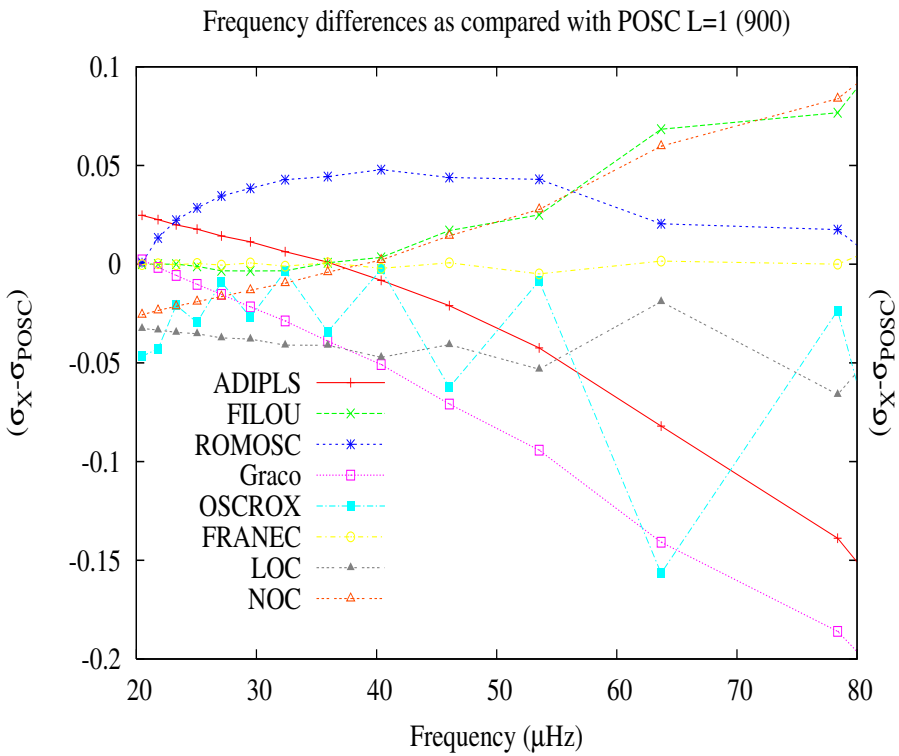
Summary of differences resp. POSC

	ℓ=0		ℓ=1	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	0.03	0.018	0.46	0.143
FILOU	-0.12	0.065	-0.22	0.078
GraCo	-0.42	0.296	-0.50	0.224
LOC	0.03	0.018	1.62	0.247
NOC	-0.10	0.055	-0.19	0.065
ROMOSC	0.71	0.463	0.52	0.359
FRANEC	-0.03	0.016	-1.04	0.141
OSCROX	0.06	0.034	1.69	0.302

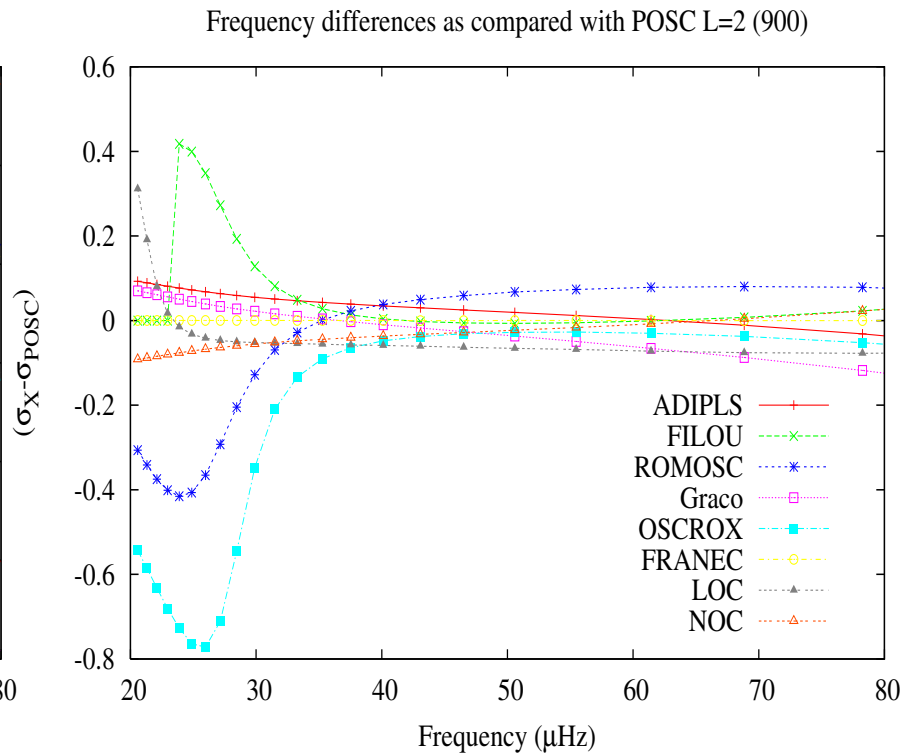
Frequency comparison

γ Doradus-like region (900)

ℓ=1



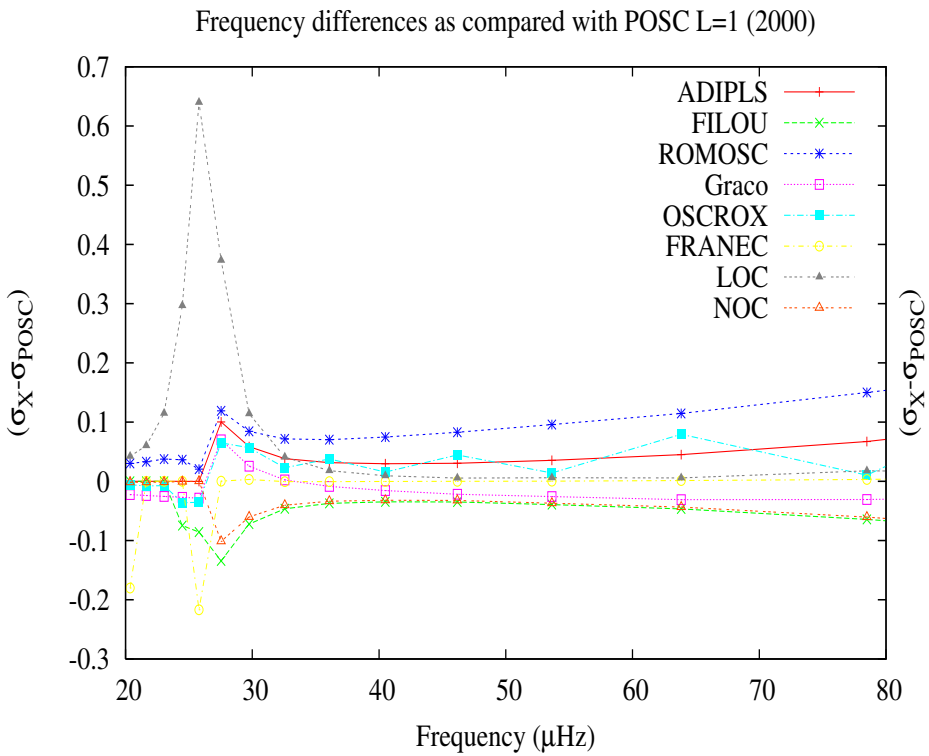
ℓ=2

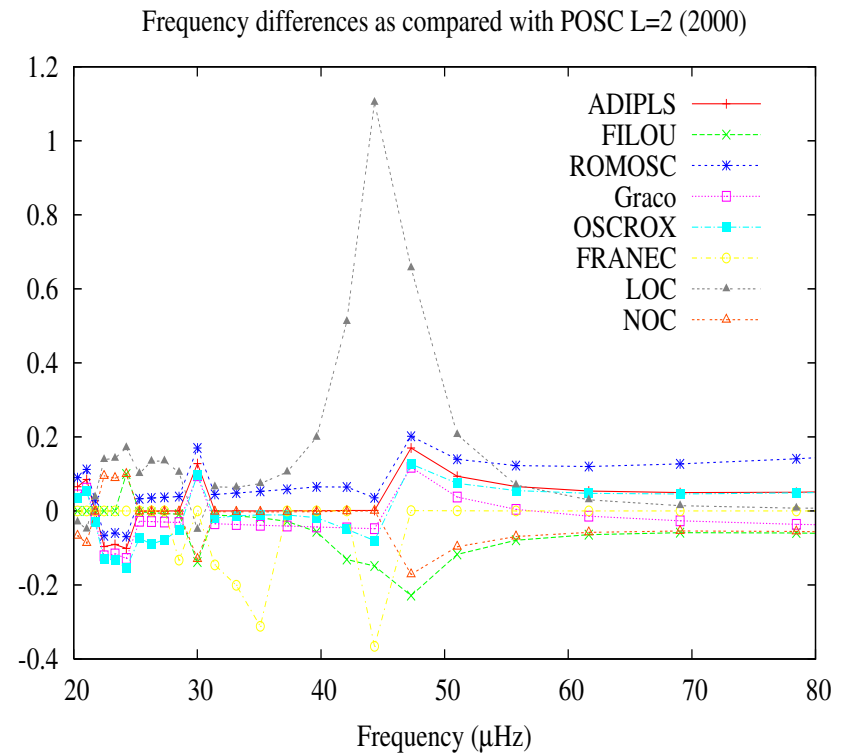


Frequency comparison

γ Doradus-like region (2000)

ℓ=1 ℓ=2





Frequency comparison γ Doradus-like region

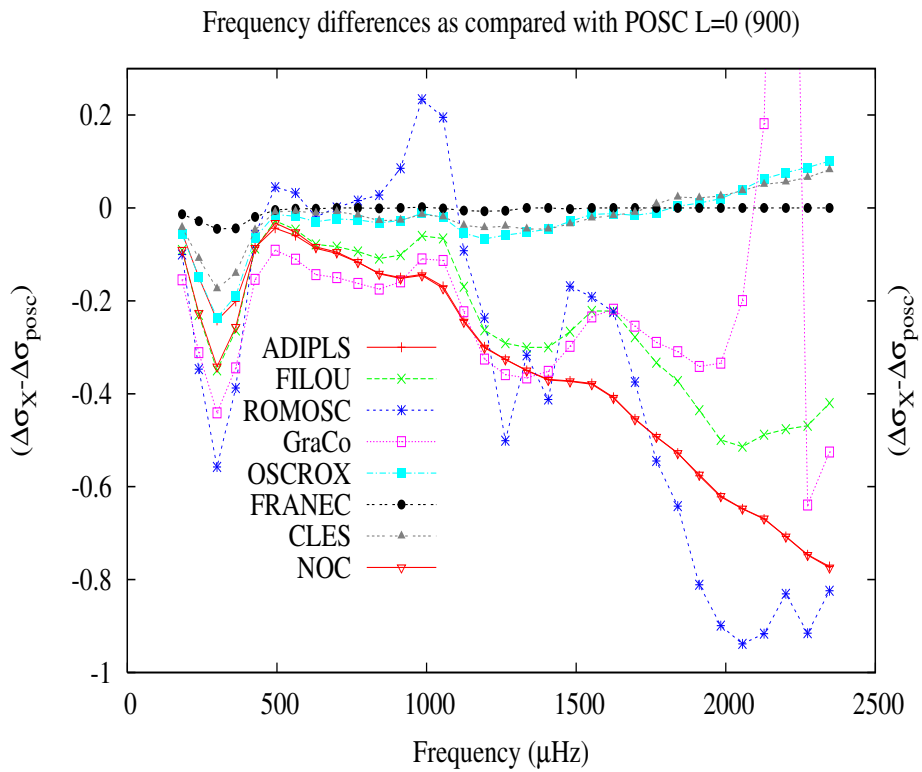
Summary of differences resp. POSC

	ℓ=1		ℓ=2	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	-0.10	0.031	0.17	0.044
FILOU	-0.13	0.048	-0.23	0.053
GraCo	0.07	0.026	-0.13	0.051
LOC	0.64	0.125	1.10	0.175
NOC	-0.10	0.032	-0.17	0.046
ROMOSC	0.15	0.073	0.20	0.082
FRANEC	-0.22	0.029	-0.37	0.048
OSCROX	0.08	0.031	-0.16	0.064

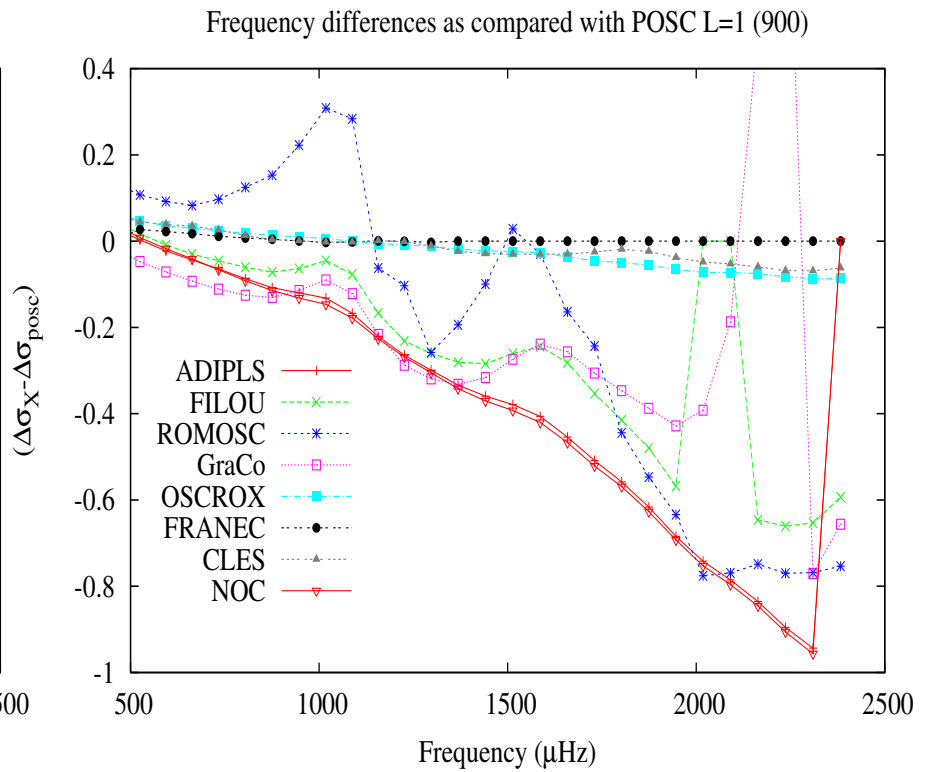
Asymptotic properties comparison

Large separation (900)

ℓ=0



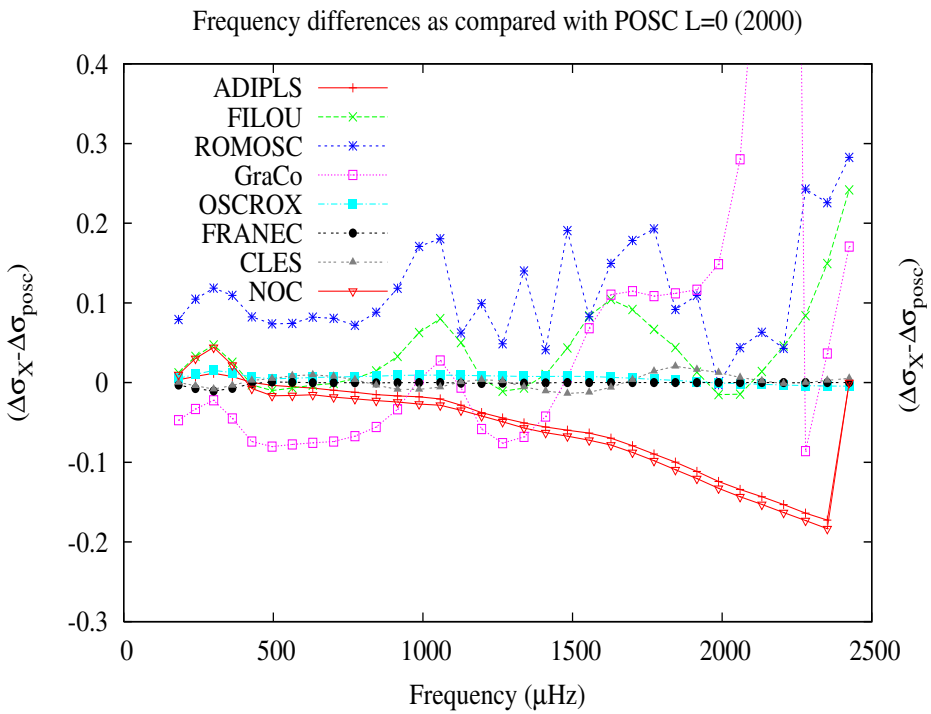
ℓ=1



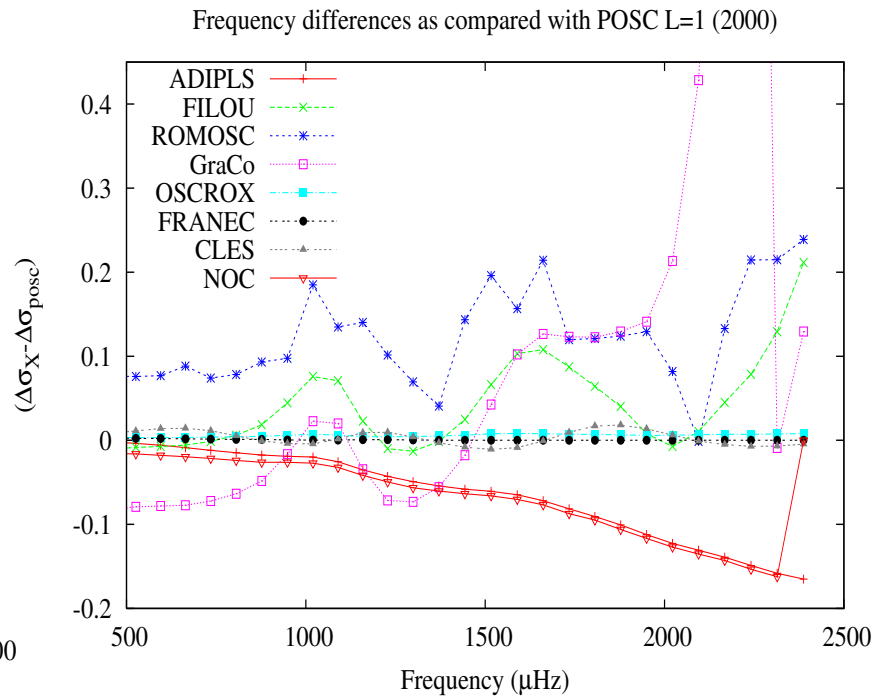
Asymptotic properties comparison

Large separation (2000)

ℓ=0



ℓ=1



Asymptotic properties: large separation

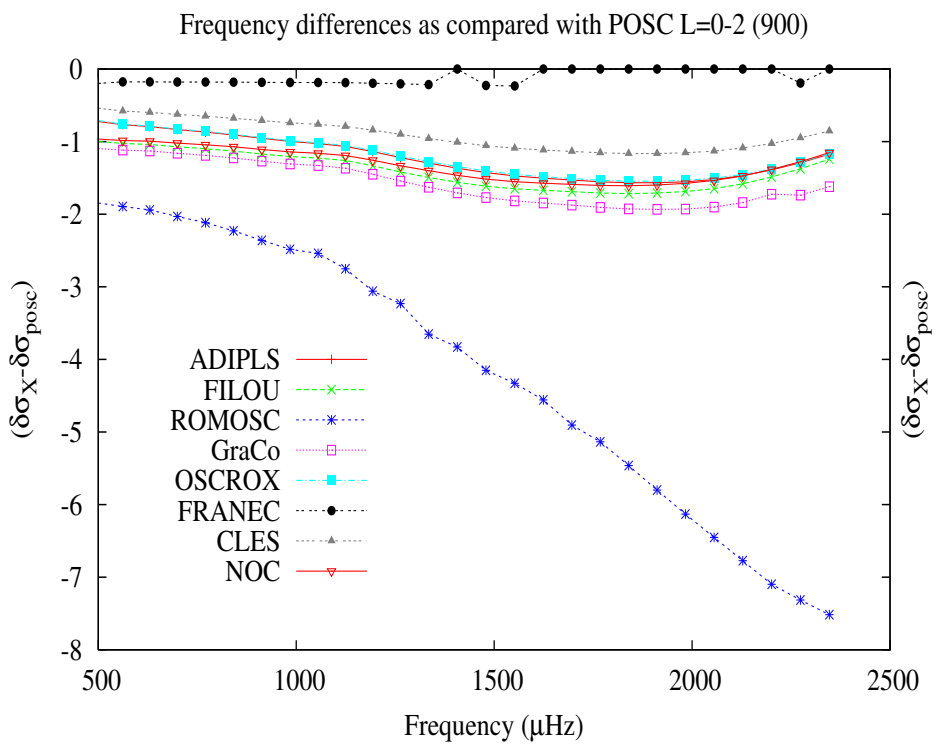
Summary of differences resp. POSC

	ℓ=0		ℓ=1	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	-0.17	0.055	-0.17	0.067
FILOU	-0.24	0.043	0.21	0.047
GraCo	2.61	0.168	1.97	0.196
LOC	0.02	0.007	0.02	0.008
NOC	-0.18	0.065	-0.16	0.067
ROMOSC	0.28	0.113	0.24	0.124
FRANEC	-0.01	0.001	0.01	0.000
OSCROX	0.02	0.006	0.01	0.006

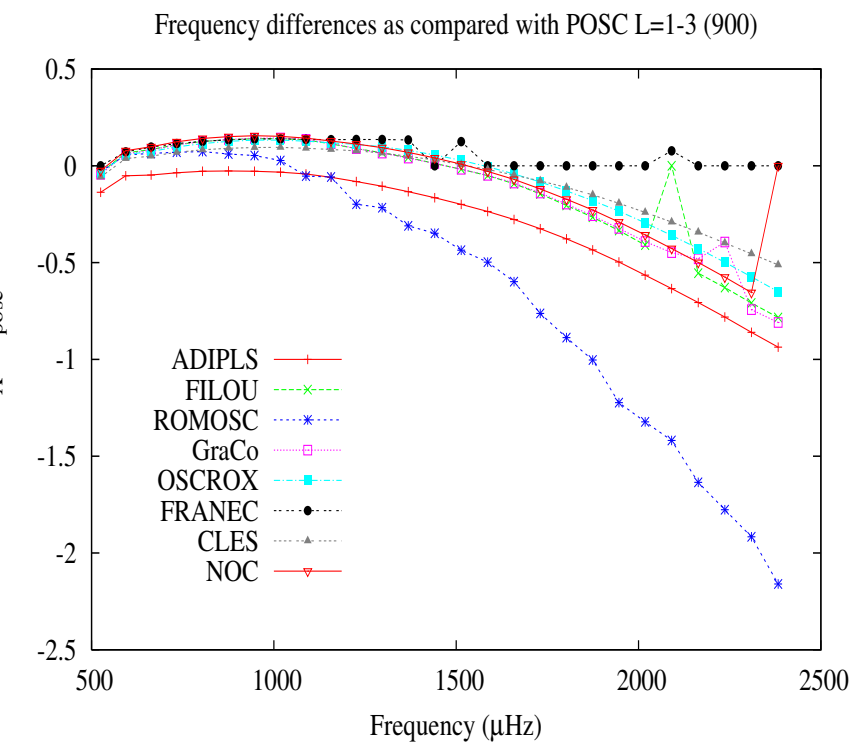
Asymptotic properties comparison

Small separation (900)

ℓ=0-2



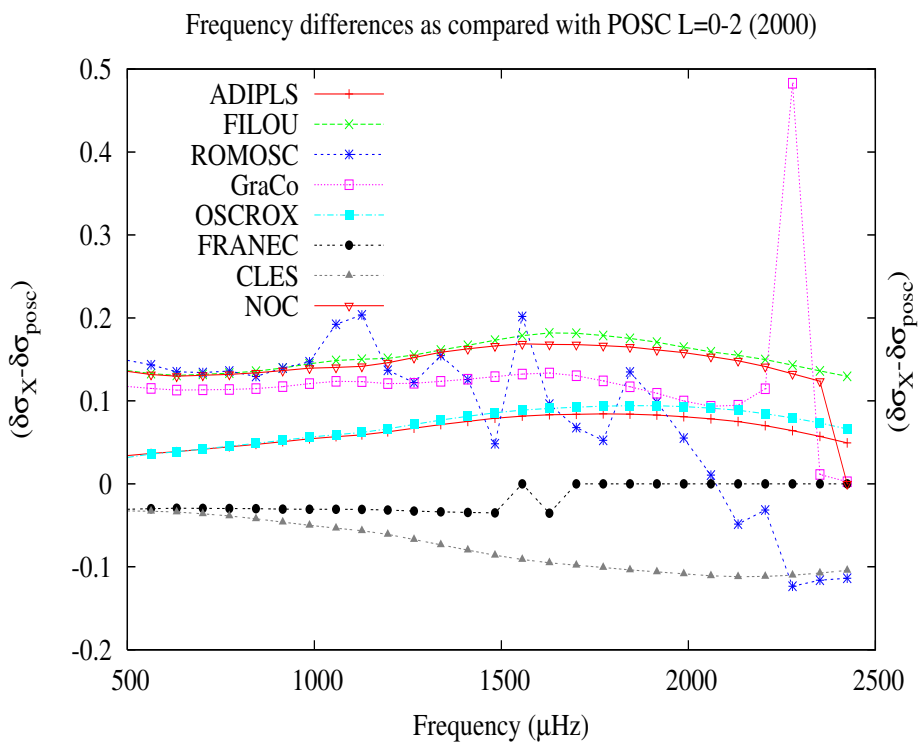
ℓ=1-3



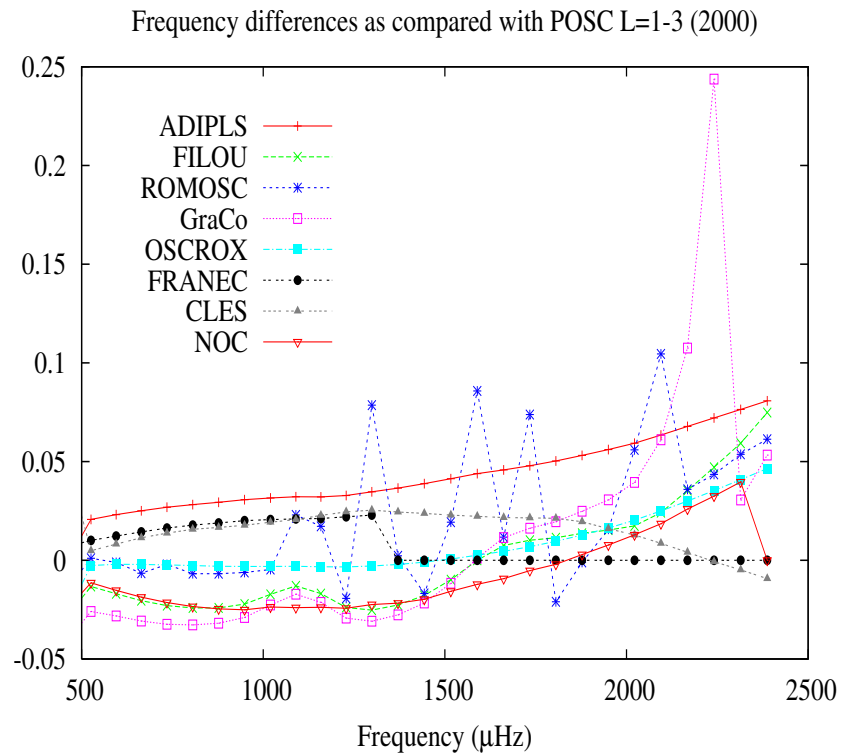
Asymptotic properties comparison

Small separation (2000)

ℓ=0-2



ℓ=1-3



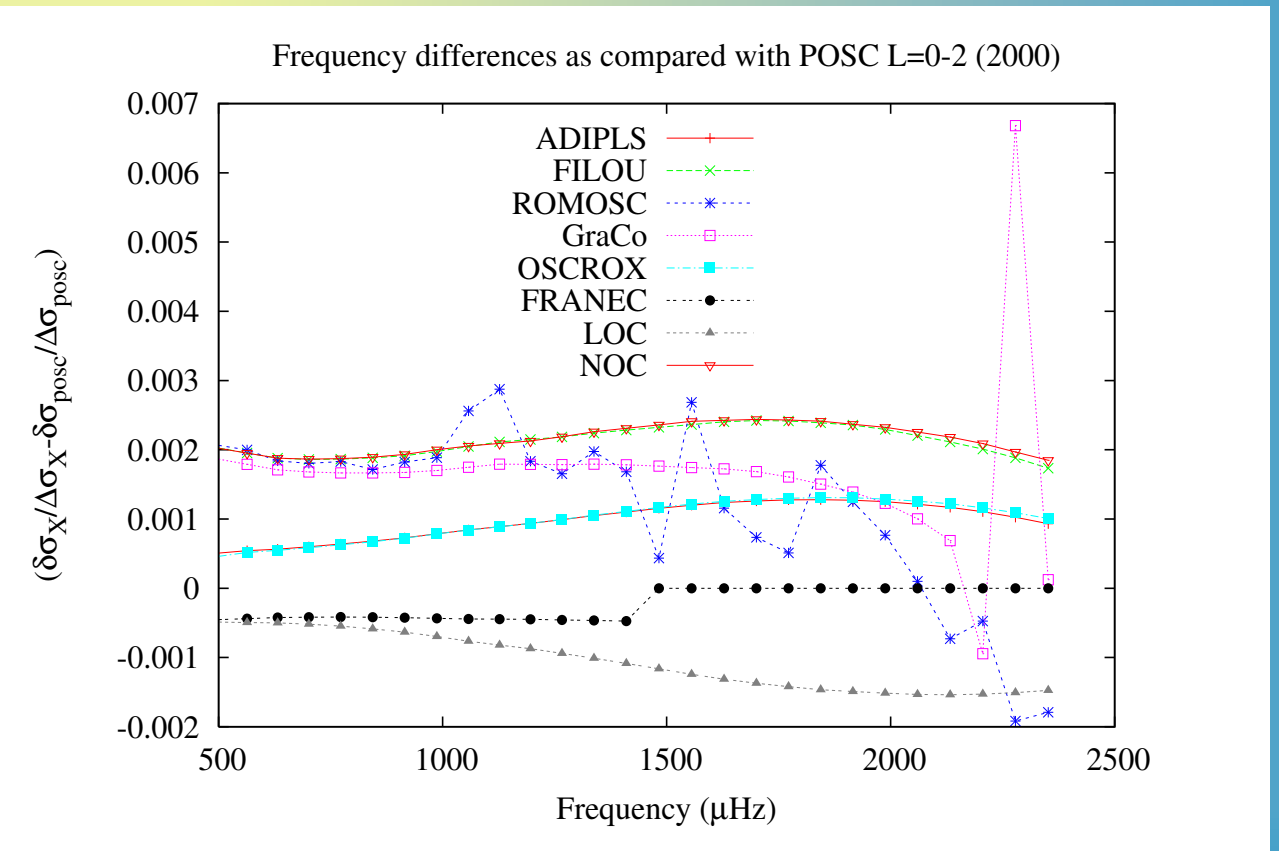
Asymptotic properties: Small separation

Summary of differences resp. POSC

	ℓ=0-2		ℓ=1-3	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	-0.12	0.063	0.08	0.044
FILOU	0.18	0.153	0.07	0.022
GraCo	0.48	0.119	0.24	0.038
LOC	-0.11	0.079	0.05	0.016
NOC	0.17	0.138	0.04	0.018
ROMOSC	0.20	0.115	0.10	0.029
FRANEC	-0.04	0.017	0.10	0.008
OSCROX	-0.12	0.072	0.05	0.011

Asymptotic properties comparison

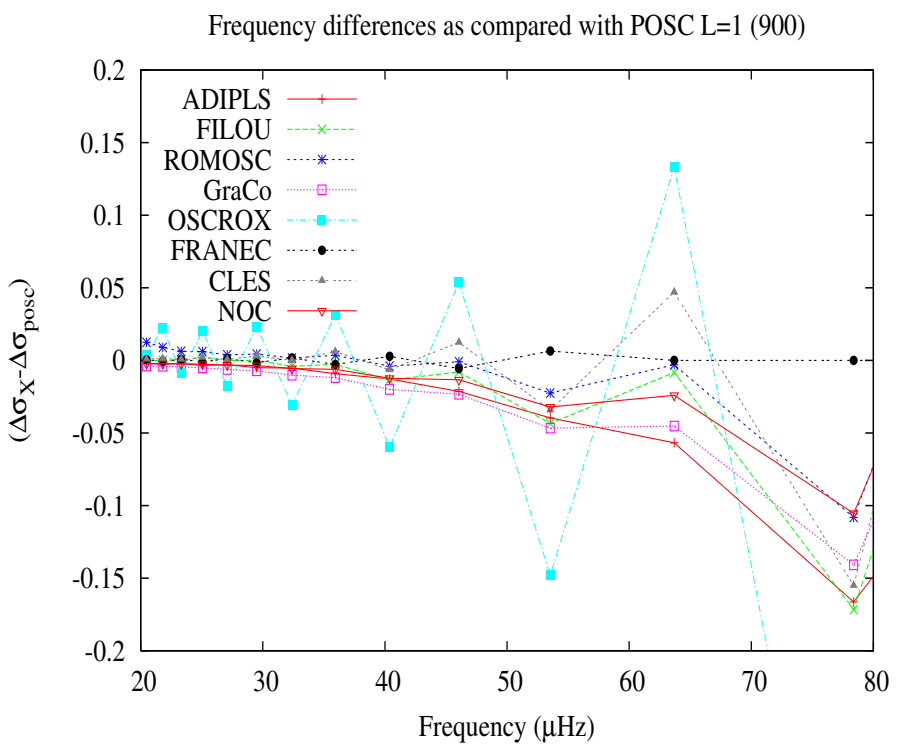
Small over large separation



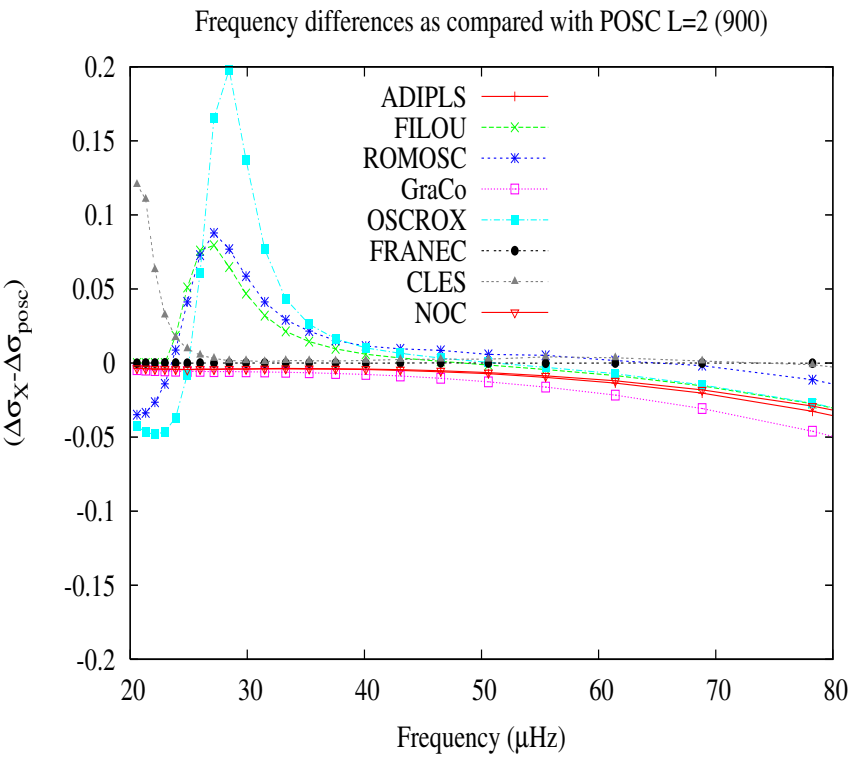
Asymptotic properties comparison

g-mode separation (900)

ℓ=1



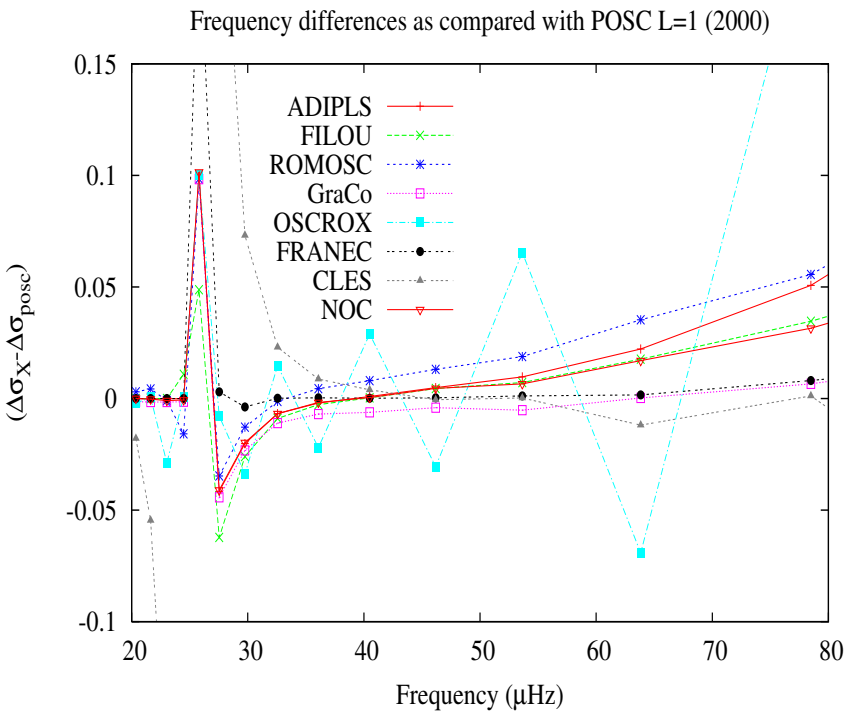
ℓ=2

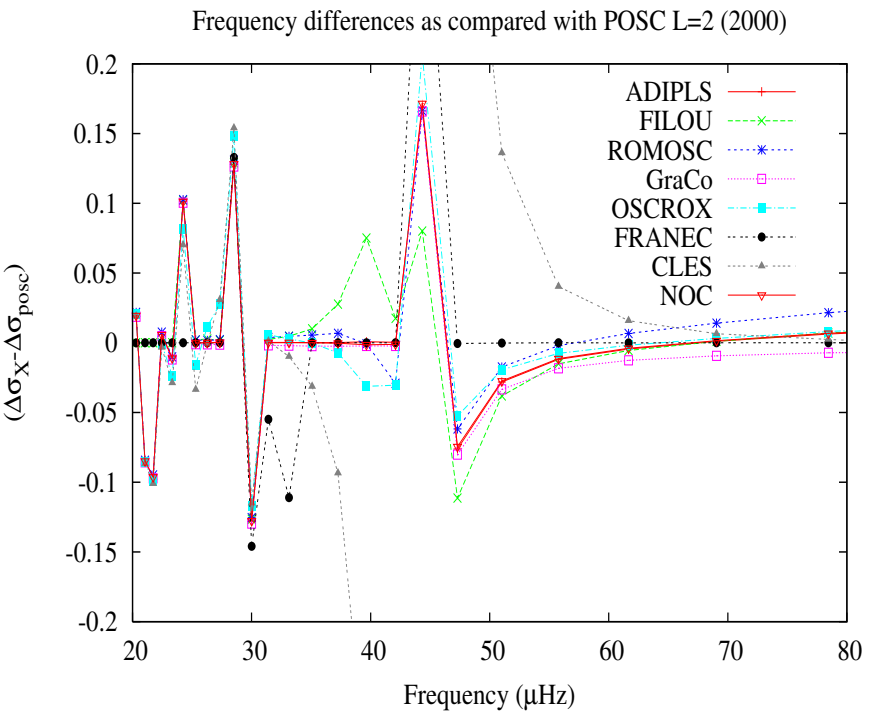


Asymptotic properties comparison

g-mode separation (2000)

ℓ=1 ℓ=2



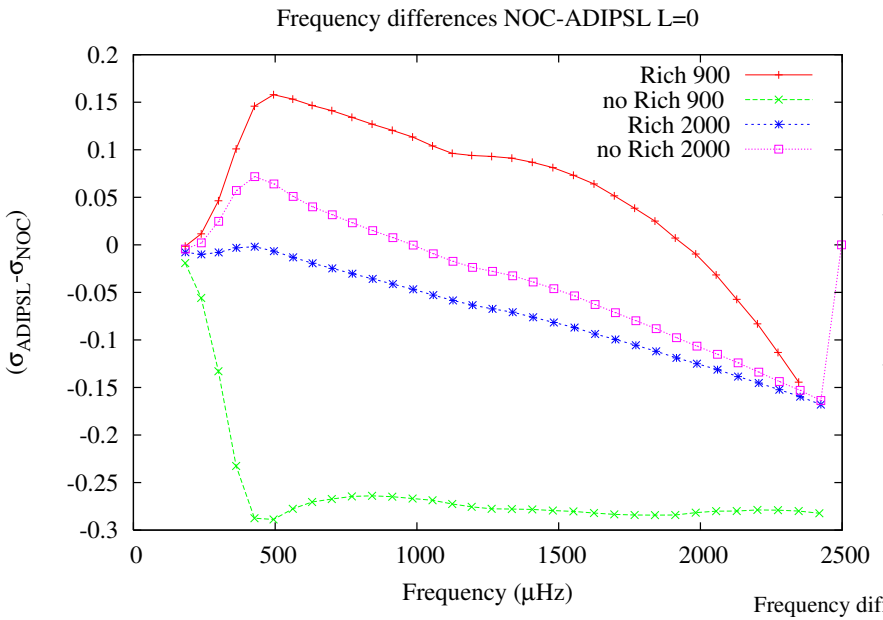


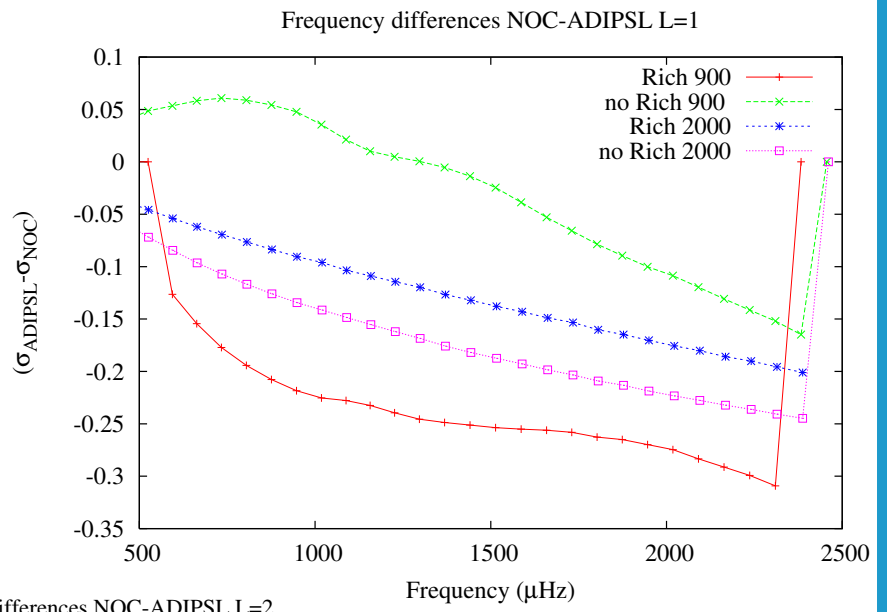
Asymptotic properties: g-mode separation

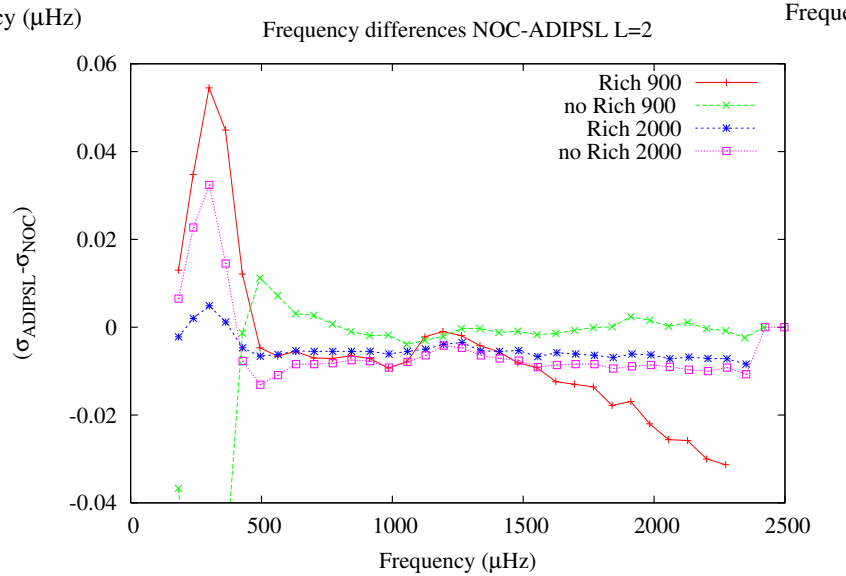
Summary of differences resp. POSC

	ℓ=1		ℓ=2	
	Max. absolute difference	Aver. absolute difference	Max. absolute difference	Aver. absolute difference
ADIPLS	0.10	0.019	0.17	0.036
FILOU	-0.06	0.016	0.13	0.032
GraCo	0.10	0.015	0.17	0.038
LOC	-0.34	0.089	-0.59	0.116
NOC	0.10	0.017	0.17	0.036
ROMOSC	0.10	0.022	0.17	0.038
FRANEC	1.27	0.108	2.17	0.153
OSCROX	0.22	0.045	0.21	0.042

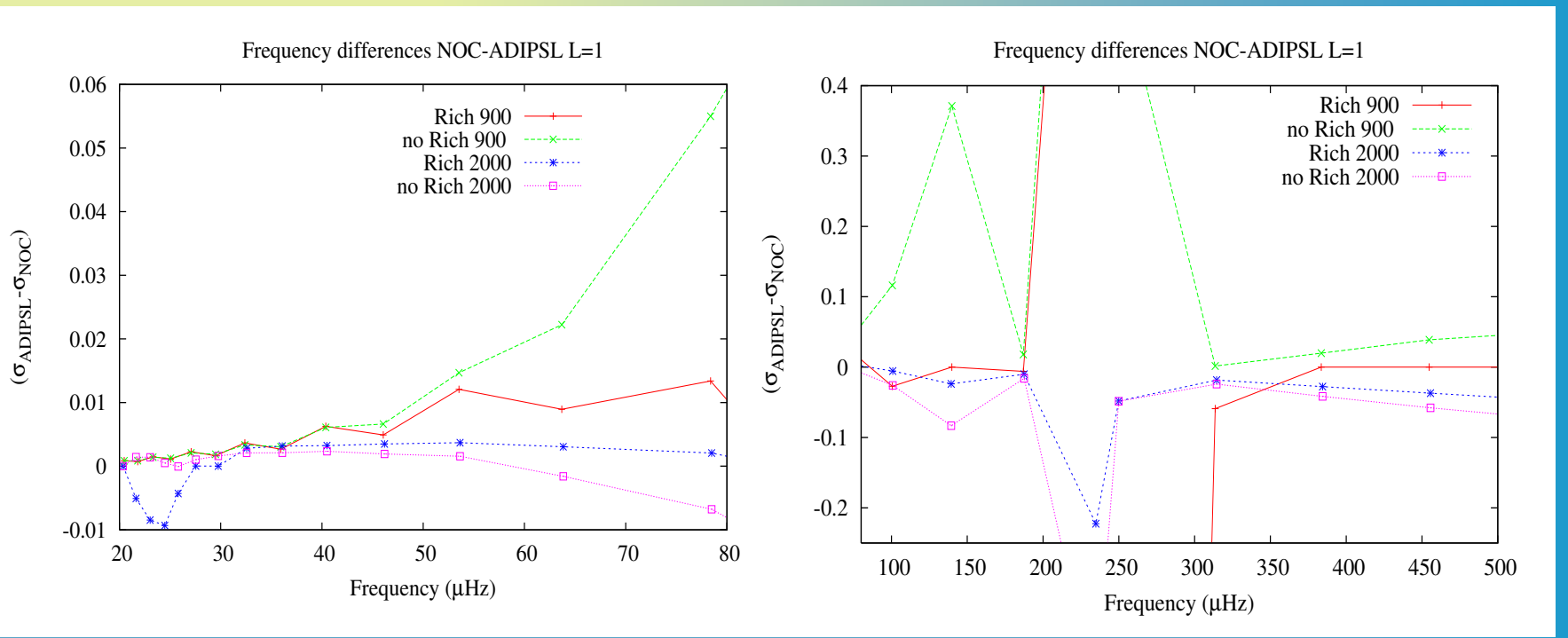
Richardson extrapolation





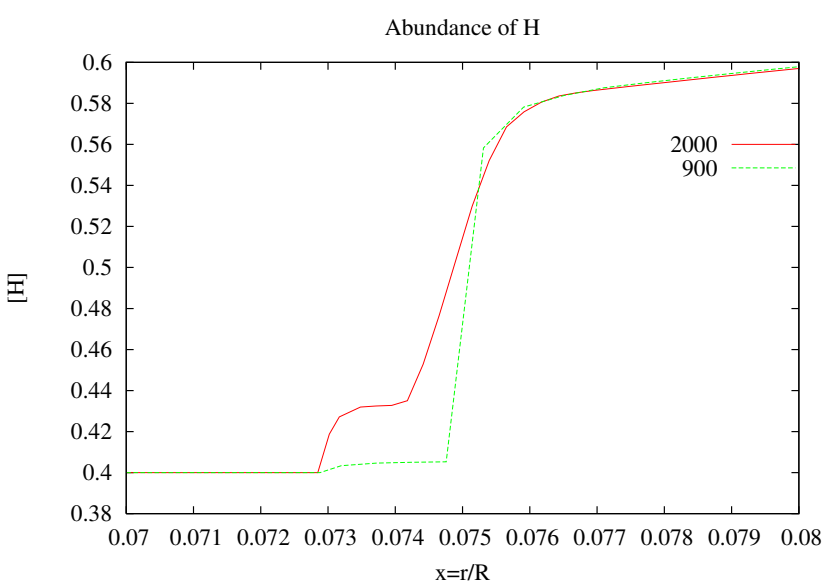


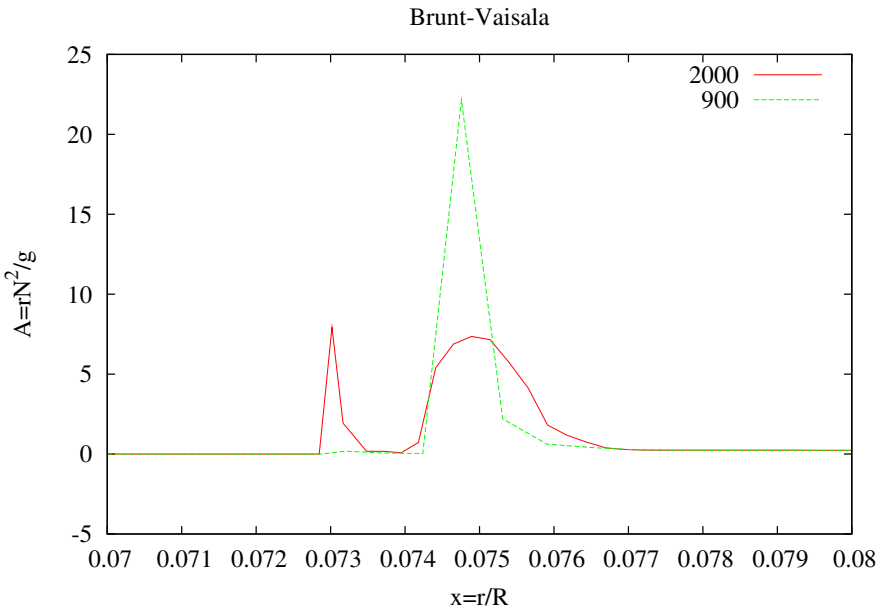
Richardson extrapolation

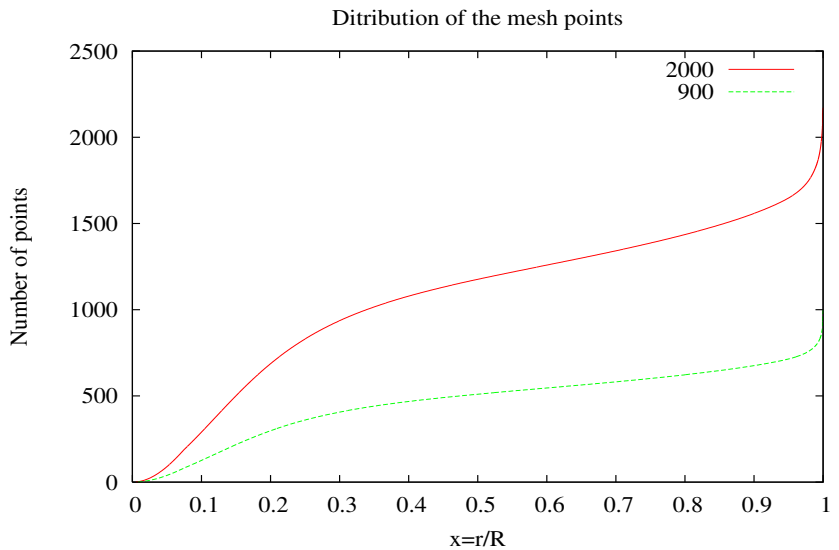


Conclusions and further work

1. Find an explanation for the differences presented here and away to solve them.
2. Therefore we need to work directly on each particular case.
3. Study other HR diagram positions as β Ceph. or SPB stars.
4. More information and contributions in: http://www.astro.up.pt/corot/compfreqs/task2.html


Abundance of H
[H]
x=r/R
2000
900
0.6
0.58
0.56
0.54
0.52
0.5
0.48
0.46
0.44
0.42
0.4
0.38
0.07 0.071 0.072 0.073 0.074 0.075 0.076 0.077 0.078 0.079 0.08


Brunt-Vaisala
A=rN²/g
x=r/R
2000
900
25
20
15
10
5
0
-5
0.07 0.071 0.072 0.073 0.074 0.075 0.076 0.077 0.078 0.079 0.08


Ditribution of the mesh points
Number of points
x=r/R
2000
900
2500
2000
1500
1000
500
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

Example about Richardson extrapolation:

	LOC	Graco no RI	GraCo with RI
Frequency ℓ=0,n=23	2922.45	2925.30	2921.25

H0(FILOU)=2924.87 μHz

H0(NOC)=2926.8 μHz

H0(ADIPLS)=2922.6471 μHz

H0(POSC)=2923.2584 μHz

Example about constant G:

	Graco $G=6.673\cdot10^{-8}$	Graco $G=6.67232\cdot10^{-8}$	GraCo $G=6.671682\cdot10^{-8}$
Frequency H0	254.0617 μHz	254.0482 μHz	254.0356 μHz

H0(LOC)=254.0304 μHz

H0(NOC)=254.05 μHz

H0(ADIPLS)=254.0438 μHz

H0(POSC)=254.051 μHz

	Groups with similar behaviors		
Frequencies	LOC-ADIPLS-OSCROX (linear)	POSC-OSCROX (cubic)	FILOU-GraCo
Large separation L=0	LOC-ADIPLS-OSCROX (linear)	POSC-OSCROX (cubic)	FILOU-GraCo
Large separation L=1	LOC-ADIPLS-OSCROX (lin)-POSC-OSCROX (cubic)	FILOU-GraCo	
Small separation L=0-2	LOC-ADIPLS-OSCROX (lin)-NOC	GraCo-POSC-OSCROX (cubic)	
Small separation L=1-3	LOC-ADIPLS-OSCROX (lin)-POSC	GraCo-FILOU-NOC	

We need a better knowledge about how we treat boundaries and the constants used.

Optimize number and distribution of mesh points.