TiO ISOTOPES BANDS IN THE M DWARF SPECTRA

O. Ivanyuk[1], Ya.V. Pavlenko[1], H.R.A. Jones[2], D. Pinfield[2], J.R.A. Clarke[2]
[1] Main Astronomical Observatory of NASU, Ukraine
[2] University of Hertfordshire, UK

ABSTRACT. A few TiO isotopes are responsible for formation different molecular features in M-Dwarfs. We present spectral analysis for moleculrar spectrum TiO (Schwenke 1998) consists of 5 Titanium isotopes: ^{46}Ti, ^{47}Ti, ^{48}Ti, ^{49}Ti, ^{50}Ti. Results denote most influent isotopes in our observational spectrum. Our main aim is to find some remarkable isotope features in the observed spectra of M Dwarf.

Key words: : late-type stars, molecular spectra;

1. Introduction

TiO is the most abundant of the 3D oxides present in the spectra of M and S class stars (Merrill et. al. 1962). TiO bands are used for spectral classification of cold stars (Morgan et. al. 1973). The distribution of intensities in the rotational structure of TiO bands can be used to determine the temperature of stellar atmospheres (Phillips 1973).

2. Observational Spectrum

M Dwarf 2MASS J02495798-2147267 is a potential Moving Group member which is good for understanding cool and low gravity atmospheres. Distanc is 26-40 pc, apparent magnitude is 13.27 ± 0.03, spectral type is M6.0 (Clarke et. al. 2009).

3. Synthetic Spectrum

Model Atnospheres. We used LTE/1D model of atmosphere with these parameters T_{eff} = 2800K and $\lg g$ = 5, [Fe/H] = 0 (Hauschildt et. al. 1999). Synthetic spectra were computed using WITA6 (Pavlenko 2003). Rotational profile has been applied with V sin i = 1.5 km/s.

TiO Linelist. Our synthetic spectra is computed for TiO list developed by Shwenke (1998) There is a number of constraints that limits its features. One is the inclusion of only a small number of electronic states. Another is the incompleteness in the electronic structure calculations, including the neglect of smaller relativistic corrections to the Hamiltonian. Finally, there can be inaccuracies in the parameters determining the potential-energy curves. These are mostly obtained from experimental analysis. List includes lines for all five Ti isotopes bound with ^{16}O. Next table shows the adopted relative abundances of Ti isotopes.

Ti Isotope	Relative Abundance
^{46}Ti	0.0793
^{47}Ti	0.0793
^{48}Ti	0.7393
^{49}Ti	0.0552
^{50}Ti	0.0534

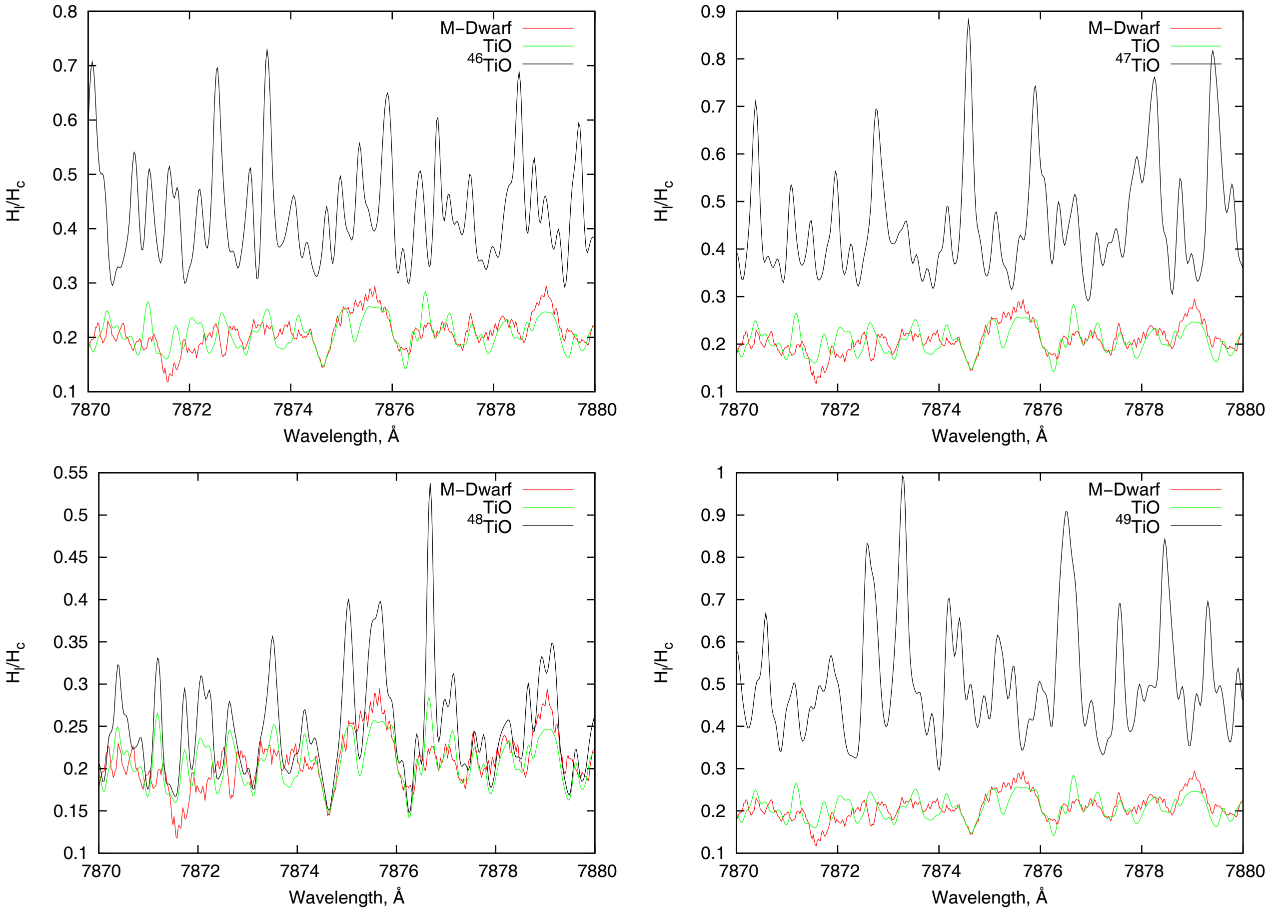
4. Results

Each figure denotes comparison of observational and TiO isotopes spectrum. We didnt account atomic spectrum due to its of much weaker intensities. First figure shows smoothed TiO and observed 2MASS J02495798-2147267 spectrum. Only small fraction of lines is in a good agreement with observational data. That could be explained with linelist constrains and not well-known metallicity values. Anyway, we can clearly distinguish the individual TiO isotope lines.

Most abundant ^{48}Ti isotope demonstrates the largest contribution in common Titanium spectrum. However, not all details can be described by only ^{48}Ti. We tried to find any relationship with other isotopes. Next figures portray each isotopes shape in a comparison with observed spectra in an attempt to dig these details.

We belive that we able to separate lines of different Titanium isotopes, despite their much smaller contribution in the combined spectrum. It proves our ability of further research we are intend to conduct on late type M dwarfs and TiO molecule.

Acknowledgements. This work was supported by the FP7 project RoPACS (ROPACS PITN-GA-2008-213646) and the program Cosmomicrophysics of NAS of Ukraine.



Figures 1, 2, 3 and 4. Spectra of ^{46}Ti, ^{47}Ti, ^{48}Ti and ^{49}Ti isotopes relatively to composite TiO and M Dwarf spectra.

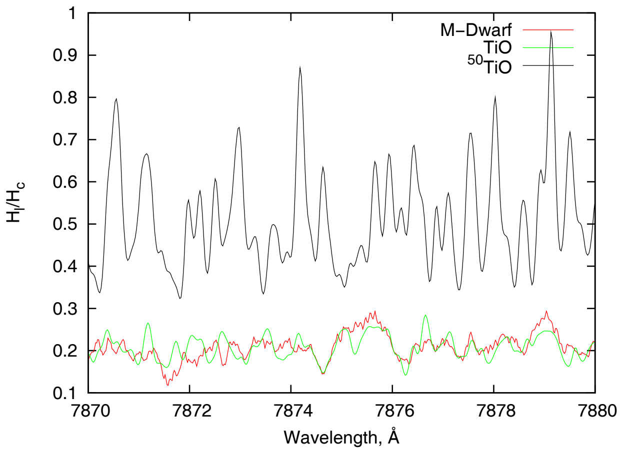


Figure 5. Spectra of ^{50}Ti isotope relatively to composite TiO and M Dwarf spectra

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