INVESTIGATION OF THE WATER STRUCTURE VARIATIONS OF THE PROBES FROM RILA RIVERS VIA THE METHOD OF WATER ENERGY SPECTRUM

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Hydrogen bonds between water molecules determine the structue properties of water. H-bonds constitute a statisticaly stable net of interactions between water molecules. They explain several physical water properties: surface tension, polarization, anomal density, some thermodynamic characteristics etc.

The H-bonds, in particular due to their possible deformations, are distributed statistically around a mean value. Our experiments as well as of other researchers show, that this probability distribution of H-bonds, the so called energy spectrum, is sensible to physical and chemical influence. Due to this dependence of spectrum on chemical compositions in natural waters, or physical fields etc., water spectra reflect the joint influence of all such factors, and generally speaking, the influence of the ecosystem as a whole on the natural waters.

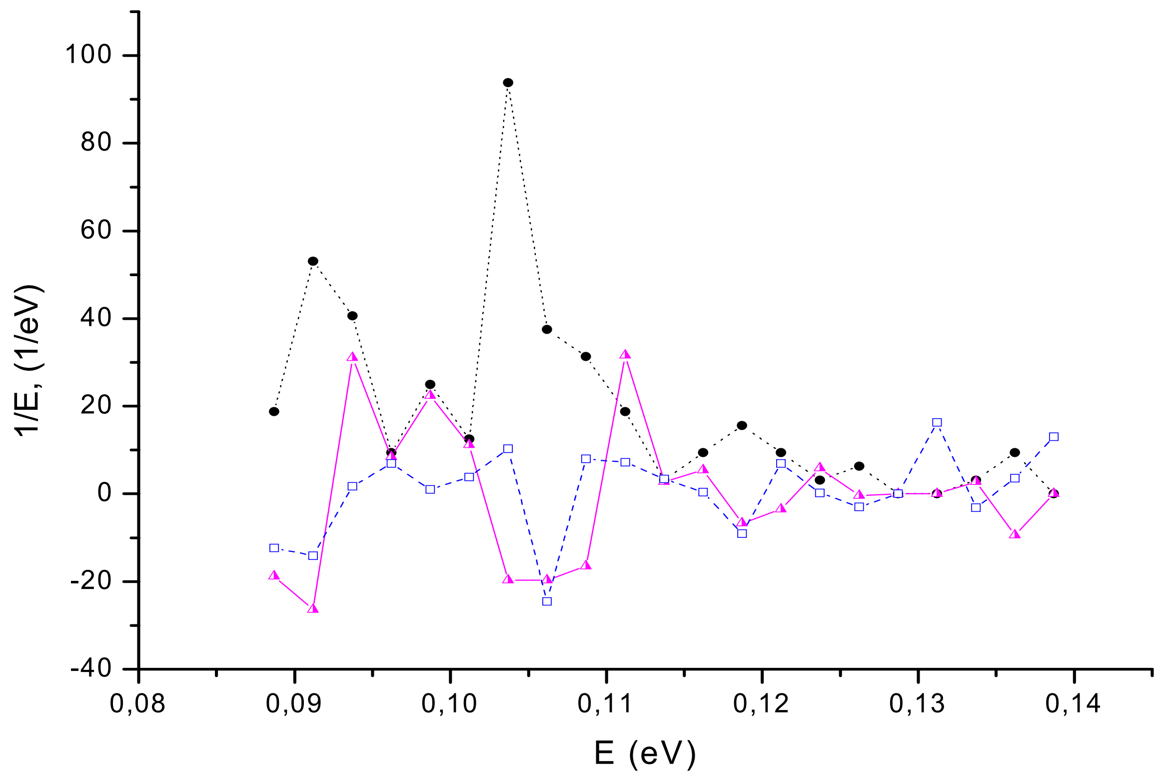
The spectrum is determined by the method of evaporating drop taken from the probe and placed on a nonwettable substrate [1,2,3])

By measurment of the drop's contact angle during the evaporation one gets the distribution of . Using one calculates by the formula [2,4]

$$f(E) = \frac{bf(\theta)}{\sqrt{1-(1+bE)^2}} \quad ,$$

where depends on the number of water molecules at the surface layer of water per unit area, on the water surface tension and the initial contact angle of the drop. Simultaneously with the probe measurment one determines the spectrum of the deionised water, the so called "control". The arithmetic difference between the two spectra is called "differential spectrum" which is independent of incidental influences on the spectrum of the probe. Various applications of the method are given in [4-8].

On Fig. 1 the differential spectra of probes are given together with the corresponding spectra of controls (up to constant). The existence of peaks on the probe spectrum indicates that for the corresponding energy values (given on the X-axis) the probability to exist H-bonds with the same energy value increases [9,10] .



- Fig.1 Differential spectra of probes and spectra of corresponding controls-circles.
- a): r.Mus. Bistriza –squares, Ledeno ezero –triangles.

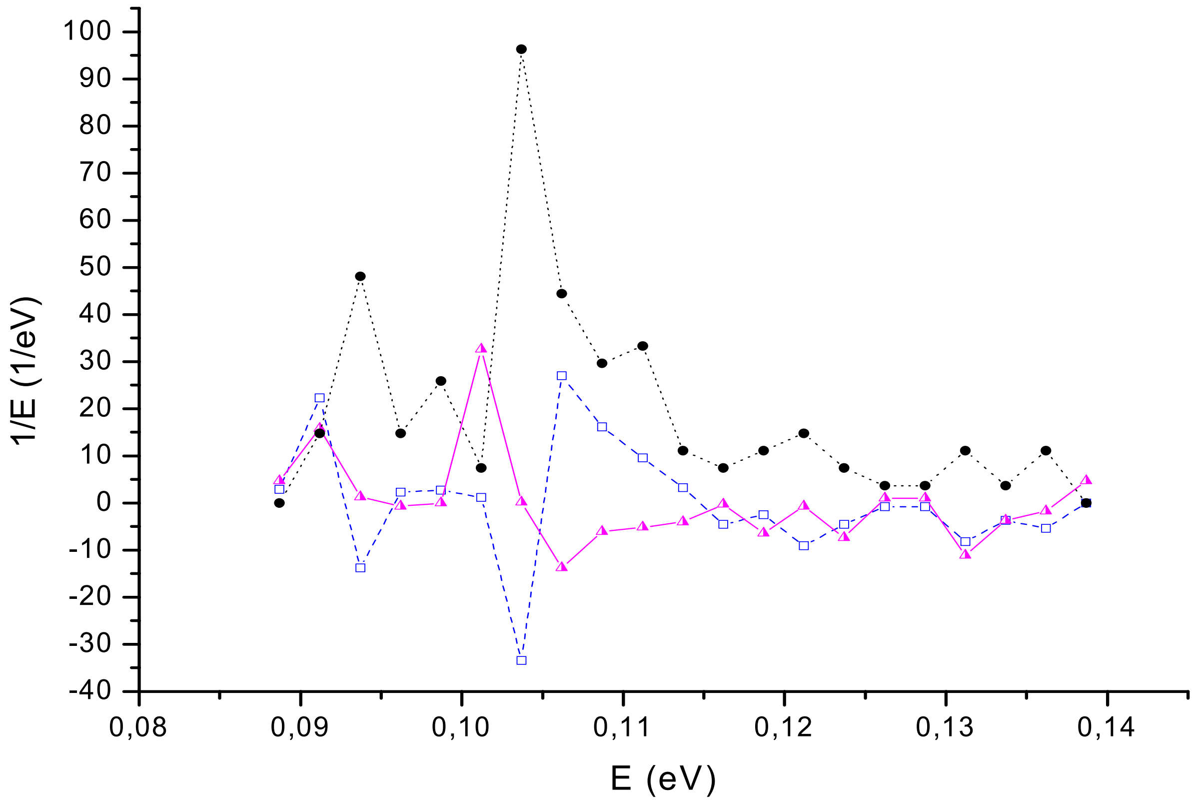


Fig.1 Differential spectra of probes and spectra of corresponding controls-circles.
b) r.Mariza-squares, r. Cherni Iskar-triangles

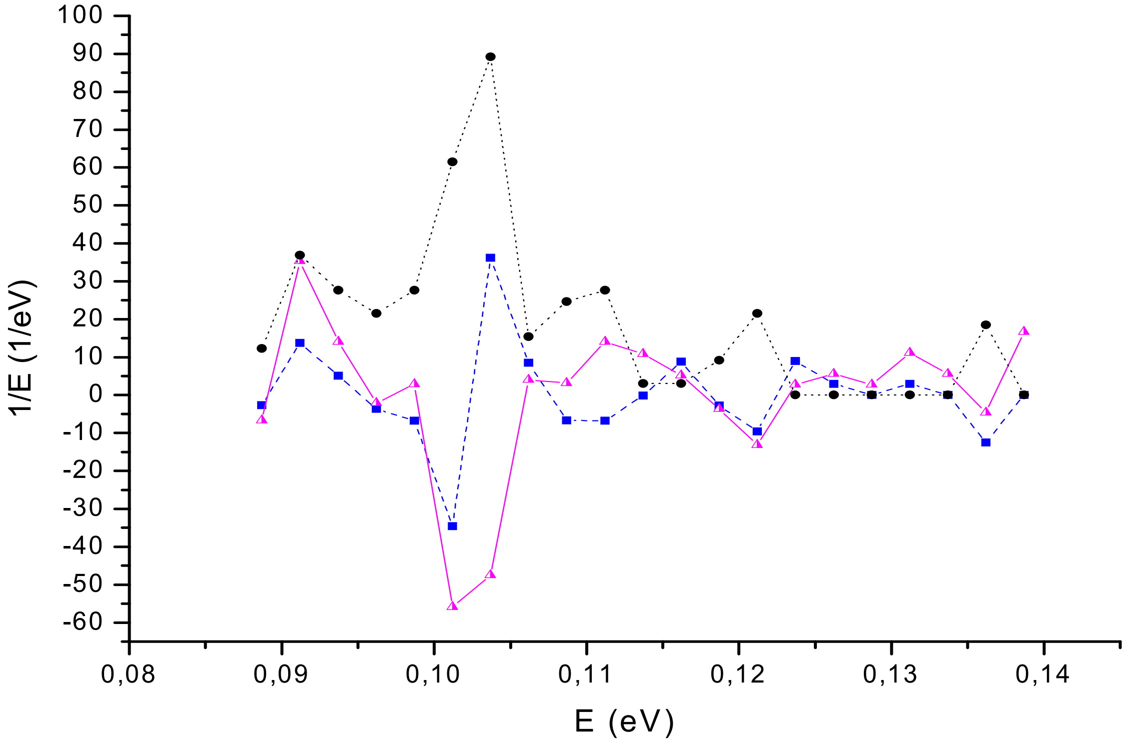


Fig.1 Differential spectra of probes and spectra of corresponding controls-circles.

c) r. Iskar-Sofia- squares, r.Iskar- Dolni Lukovit-triangles.

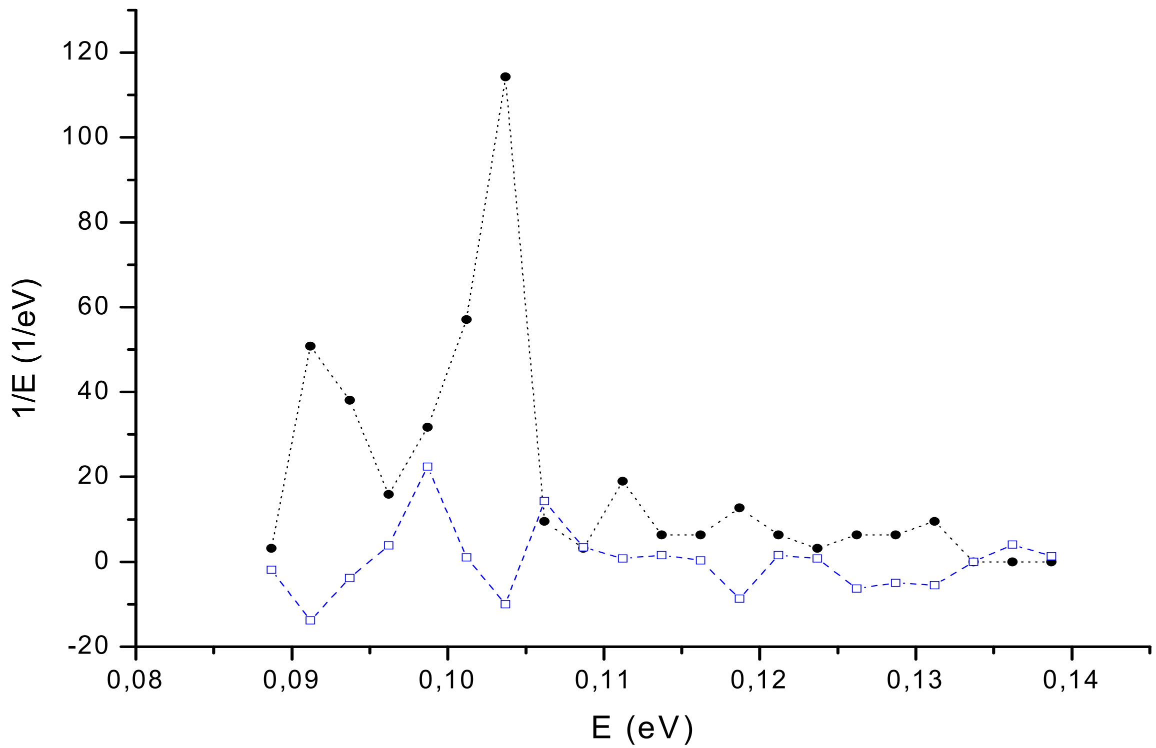


Fig.1 Differential spectra of probes and spectra of corresponding controls-circles.
d) r. Beli Iskar -Squares.

Table 1 gives some energy characteristics of probes and controls.

	P1	P2	P3	P4	P5	P6	P7
Ec (eV)	-0.136	-0.136	-0.107	-0.107	-0.1041	-0.1041	-0.1056
ΔE (10^{-3} eV)	-2,8	-0,3	2,2	2,6	0,6	-2,1	2,9

- **Table 1.** Differences E = E- Ec between mean energies of controls Ec and probes E:

- Where: P1 is Musalenska Bistritsa, P2 - Ledeno ezero, P3 - r. Maritsa,
- P4 - r.Cherni Iscar, P5 - r.Iscar (Sofia), P6 - r.Iscar (Dolni Lukovit), P7 - r.Beli Iscar.

Table 2. Correlation coefficients of spectra of probes and controls

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	P1	P2	P3	P4	P5	P6	P7	C1	C2	C3	C4
P1	1										
P2	0.37	1.00									
P3	-0.56	-0.19	1.00								
P4	0.02	0.03	0.01	1.00							
P5	-0.12	-0.35	0.29	-0.40	1.00						
P6	-0.21	0.08	0.48	-0.39	0.19	1.00					
P7	-0.07	0.30	0.32	-0.22	-0.36	-0.02	1.00				
C1	-0.17	-0.33	-016	0.10	0.59	-0.26	-0.2	1.00			
C2	0.07	-0.06	-032	-0.17	0.56	-0.33	-0.02	0.88	1.00		
C3	0.13	-0.10	-028	0.47	0.13	-0.65	-0.12	0.8	0.73	1.00	
C4	0.10	-0.08	-040	0.43	0.38	-0.53	-0.28	0.83	0.75	0.92	1.00

Conclusion

The material presented implies that a typical probability distribution of H-bonds for all the probes is the peak around -0.11eV. Another typical peak (except for the probe from Beli Iskar) is around–0.093 eV. The coefficients of linear correlation do not exeed 0.5 which implies a tendency of correlation in the cases of highest coefficients. In case of the mountain (i.e. cleaner waters- Mus. Bistriza and Ledeno ezero, are higher than the peaks at the same energy compared to the rivers near Sofia and Dolni Lukovit.

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