# STATUS OF EXPERIMENTS SEARCHING FOR *P*-, *T*-VIOLATION IN MOLECULES

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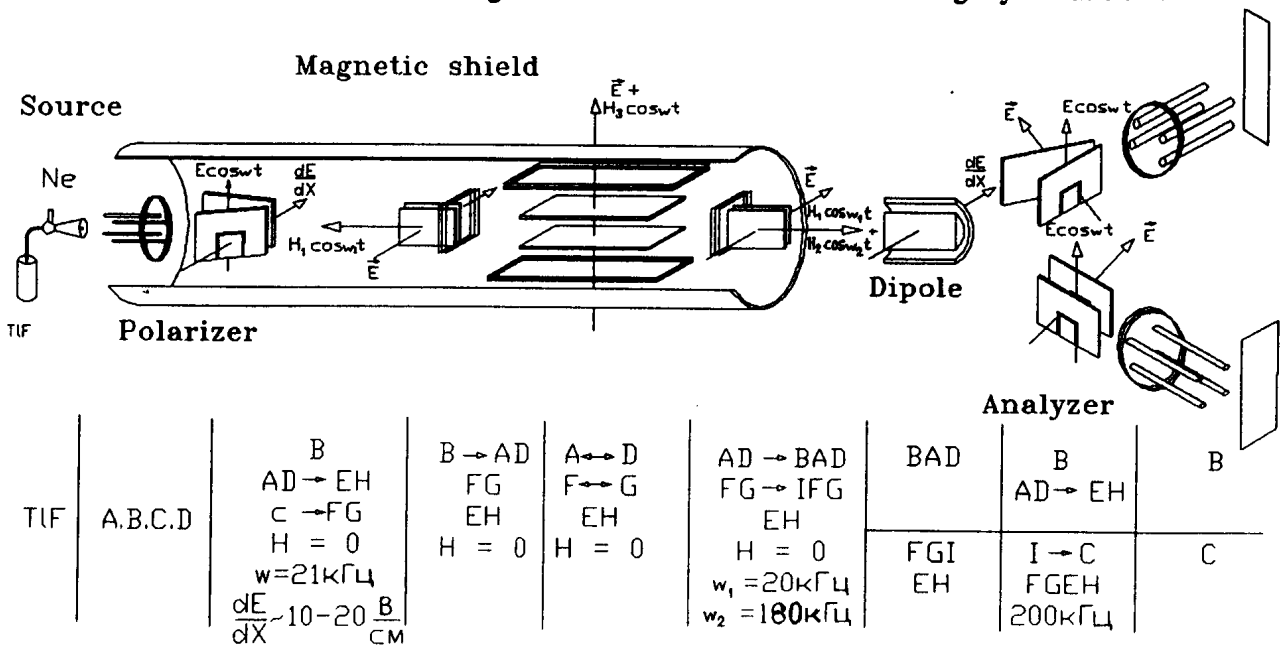
The possibility of *P*-, *T*-nonconservation in atomic and molecular systems is now widely discussed in literature [1]. This effect is strongly enhanced in heavy diatomic molecules. On the other hand, the current accuracy of molecular experiments is about $10^{-4}$ *Hz* [2], which is about four orders less than the atomic one. It was connected with the existence of specific molecular difficulties besides usual problems such as beam intensity and magnetic field stability. Among them we can mention a high density of molecular levels, difficulties of molecular detection and large value of Stark effect which causes large systematic error.

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|---|---|---|---|---|---|---|---|---|
| TlF | A.B.C.D | B<br>AD → EH<br>C → FG<br>H = 0<br>w=21кГц<br>dE/dX ~10-20 В/см | B → AD<br>FG<br>EH<br>H = 0 | A ↔ D<br>F ↔ G<br>EH<br>H = 0 | AD → BAD<br>FG → IFG<br>EH<br>H = 0<br>w₁ =20кГц<br>w₂ =180кГц | BAD<br><br>FGI<br>EH | B<br>AD → EH<br><br>I → C<br>FGEH<br>200кГц | B<br><br><br>C |

Fig.1.

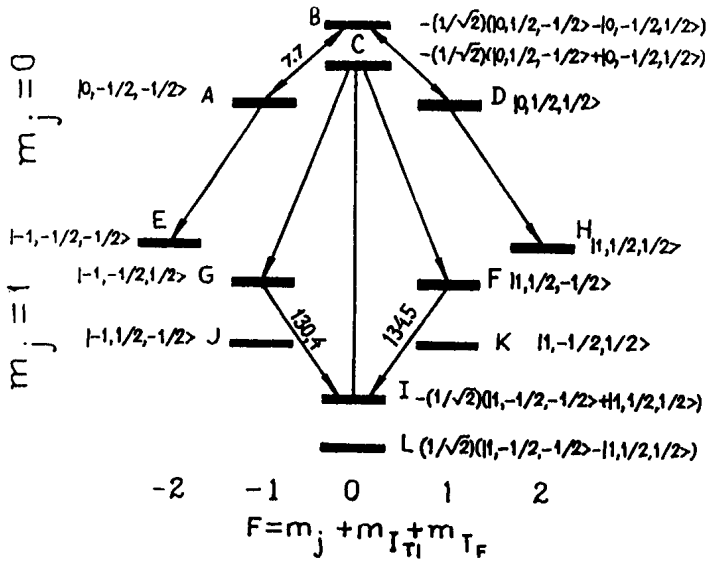


Fig.2. Hyperfine structure of 1-st rotational state of TlF in strong electric and zero marnetic fields

All these problems are taken into account in the experimental setup created in LNPI. We expect that statistical accuracy would be about $10^{-7}$ $Hz$. The scheme of this experiment for the TlF beam is given in fig.1. The hyperfine levels and rf transitions in the different parts of the experimental setup are shown in the lower part of this figure. Hyperfine structure of the first rotational state in strong electric and zero magnetic field is shown in fig.2.

The main features of this scheme are as follows.

1. In order to eliminate main spurious effect in our experiment, we use interference of states A and C, as well as $B$ and $H$ in the zero magnetic field rather then magnetic resonance. These pairs of states are degenerate in zero magnetic field, so phase difference between them appears only due to $P$-, $T$-odd interaction.

2. Differential experimental scheme is used. $P$-, $T$-odd effect has opposite sigh for the states $m_j = 0$ and $m_j = 1$. To distinguish between them the molecular beam is divided into two parts in electric dipole after interference region and each beam is detected separately.

Maximum efficiency for such a scheme may be obtained when a molecular beam source with molecule thermalizing in supersonic jet of carrier gas [3] is used. In this case the search for new spurious effects at the level of statistical accuracy $10^{-5} - 10^{-6}$ $Hz$ will become the main problem.

**References**


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*2. Cho D. et al. //Phys.Rev.Lett., 1989. V.63. P.2559.*
*3. Varentsov V.L. et al. //Zh.Tekhn.Fiz., 1987. V.57. P.755.*