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Electronic Supplementary Material (ESI) for RSC Advances

Study of the correlation between magnetic and electrical properties of the $La_{0.6}Sr_{0.4}MnO_3$ compound

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Contents

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Fig. S4: Fit of the temperature dependence of resistance R(T), at high temperatures, with the four transport models: **(a)** The (TAH), **(b)** the adiabatic (SPH), **(c)** the non-adiabatic (SPH) and **(d)** the (VRH).

Table S1: Refined structural parameters for $La_{0.6}Sr_{0.4}MnO_3$ (S1C0).

Space group	$P\ bnm$ **100.00 (1.72)** $a \neq b \neq c$ $\alpha = \beta = \gamma = 90\,°$
a **(Å)** b **(Å)** c **(Å)**	5.502_5 5.457_3 7.727_4
La, Ca, Sr sites *(x, y, z)* $Mult = 4$	0.997_7 0.018_8 0.25
Mn site *(x, y, z)* $Mult = 4$	0.50 0.00 0.00
O_1 *(x, y, z)* $Mult = 4$	0.075_7 0.513_5 0.25
O_2 (x, *y, z*) $Mult = 8$	$Mult = 8$ 0.711_4 0.289_0 0.015_6
V**(Å³)**	58.012
Mn- O_1-Mn **(°)** ***Mn- O_2-Mn*** **(°)** $d_{Mn\text{-}O1}$ **(Å)** $d_{Mn\text{-}O2}$ **(Å)** $\langle dMn - O\rangle$ **(Å)** $\sigma^2\langle Mn - O\rangle$	155 161 1.97_7 1.96_3 1.96_7 6.5546×10^{-5}
R_F**(%)** R_B**(%)**	3.90 2.69
R_p **(%)** R_{wp} **(%)** R_{exp} **(%)** $\chi 2$ **(%)**	13.5 9.95 6.12 2.64

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Table S2: Comparison of the magneto transport properties of $La_{0.6}Sr_{0.4}MnO_3$ (S1C0) with other materials.

Compound	$\mu_0 H\ (T)$	$T_R (K)$	MR_{max} (%)	$\lvert TCR\ (\%)\rvert_{max}$	**References**
$La_{0.6}Sr_{0.4}MnO_3$	2	222	20.1	0.84	This work
$Nd_{0.6}Sr_{0.3}K_{0.1}MnO_3$		221	39	1.3	**[45]**
$La_{0.7}Ca_{0.25}Sr_{0.05}MnO_3$	0.1	259	15.4		**[47]**
$La_{0.7}Ca_{0.15}Sr_{0.15}MnO_3$		263	14.2		**[47]**
$La_{0.7}Ca_{0.1}Sr_{0.2}MnO_3$		269	18.1		**[47]**
$La_{0.7}Ca_{0.3}MnO_3$	1	172	25		**[48]**
$La_{0.7}Ca_{0.2}Ag_{0.1}MnO_3$		200	30		**[48]**
$La_{0.7}Ca_{0.1}Ag_{0.2}MnO_3$		296	20.8		**[48]**
$La_{0.7}Ag_{0.3}MnO_3$		303	17.1		**[48]**
$La_{0.75}Sr_{0.25}Mn_{0.75}Cr_{0.25}O_3$	2	228	62		**[46]**
$La_{0.6}Sr_{0.25}K_{0.15}MnO_3$		287	45		**[52]**
$La_{0.6}Ca_{0.4}MnO_3$		220	45	1.3	**[53]**
$La_{0.5}Ag_{0.1}Ca_{0.4}MnO_3$		380		2.1	**[54]**
$La_{0.6}Eu_{0.1}Sr_{0.3}MnO_3$		360		1.1	**[55]**

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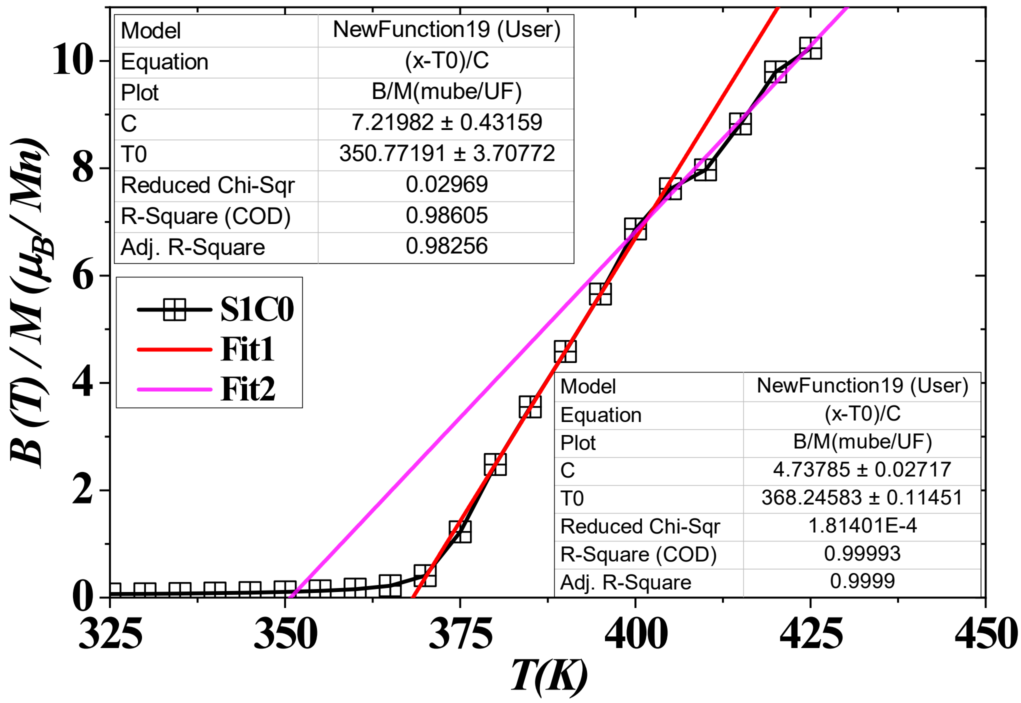

Fig. S1: The temperature dependence of the inverse of the magnetic susceptibility. The $\chi^{-1}(T)$ curve presents two linear branches. The first one is fitted with the Curie-Weiss law **[31]**, indicating the PM-FM transition at $\theta_{WC} = 368\ K$ value quite equal to the Curie temperature $T_C \approx 365\ K$. The second branch, shows the existence of another temperature characteristic of the magnetic properties $T_i \approx 350\ K$, indicating the existence of (SPM) clusters within the (FM) phase in the temperature interval between T_B and T_C. So, the irreversibility temperature T_i can be defined as the temperature of a SPM/PM transition.

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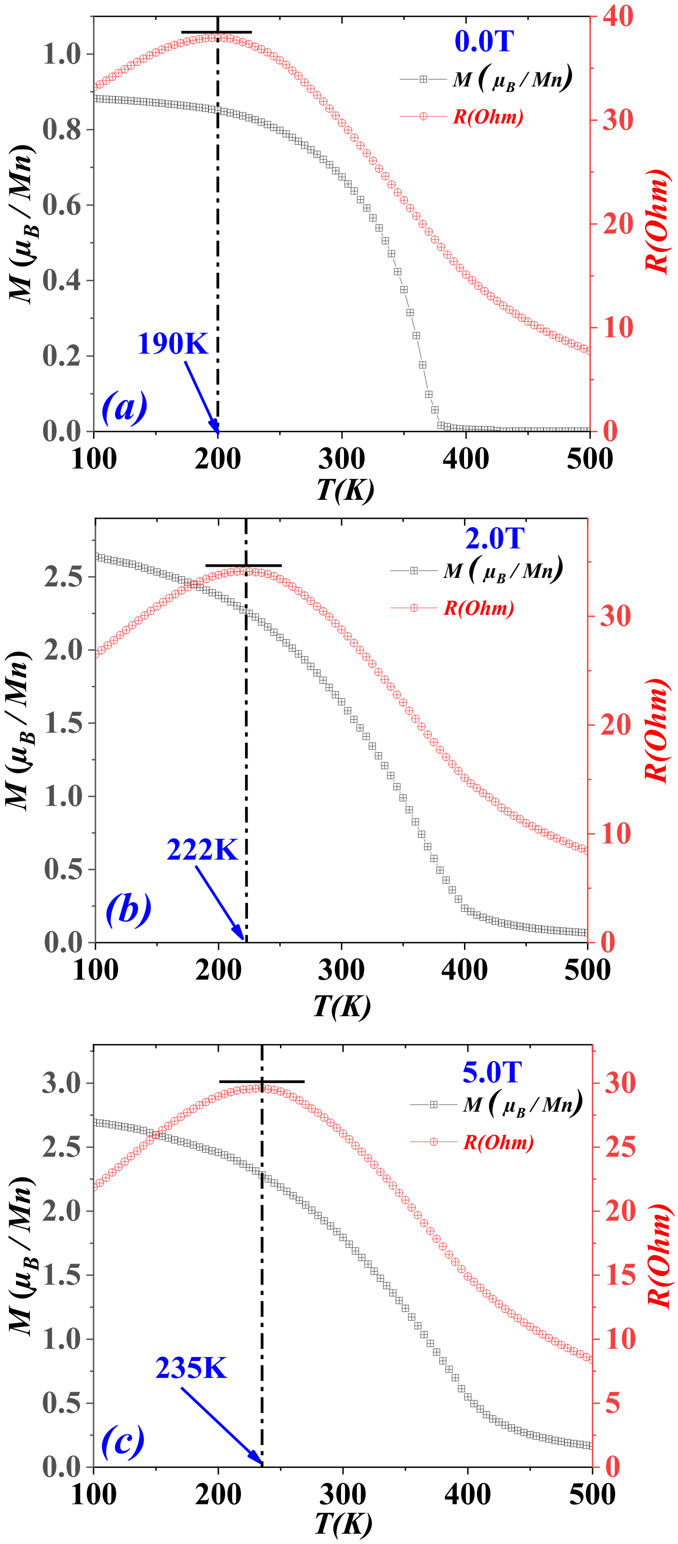

Figs. S2 (a), (b) and **(c)** the variations according to the temperature of the magnetization M(T) and the electrical resistance R(T) of (S1C0) under different applied magnetic fields of 0, 2 and 5 T, respectively.

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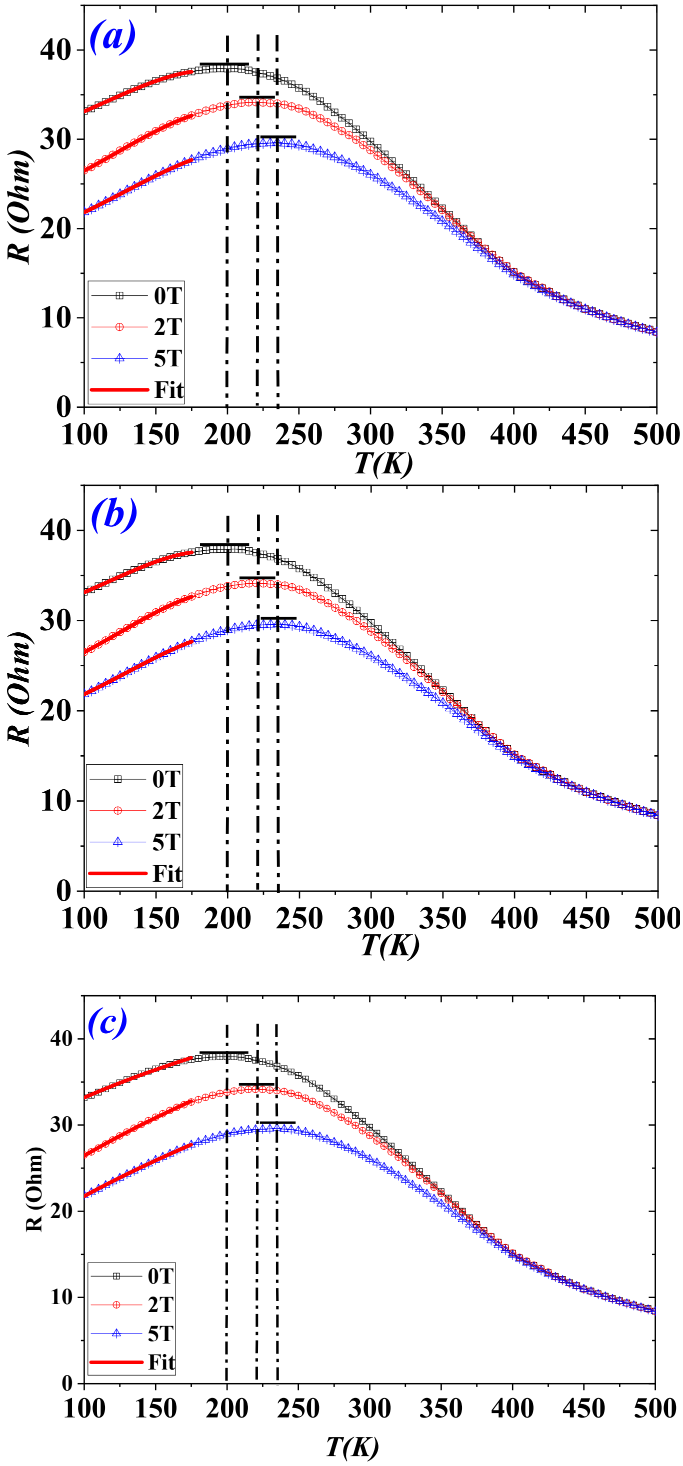

Figs. S3 : (a), (b) and **(c)** Fit of the temperature dependence of resistance, at low temperatures, under different applied magnetic fields of 0, 2 and 5 T, with the three models: **(a)** the (ZDE) polynomial $R(T) = R_0 + R_2T^2 + R_{4.5}T^{4.5}$ model with (e-m)

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interactions, **(b)** the (ZDE) polynomial $R(T) = R_0 + R_2T^2 + R_5T^5$ model with (e-ph) scattering, and **(c)** the (SPCM)

$$R(T) = R_0 + \frac{R_2}{sinh^2\left(\frac{T_2}{T}\right)} + R_nT^n$$

model.

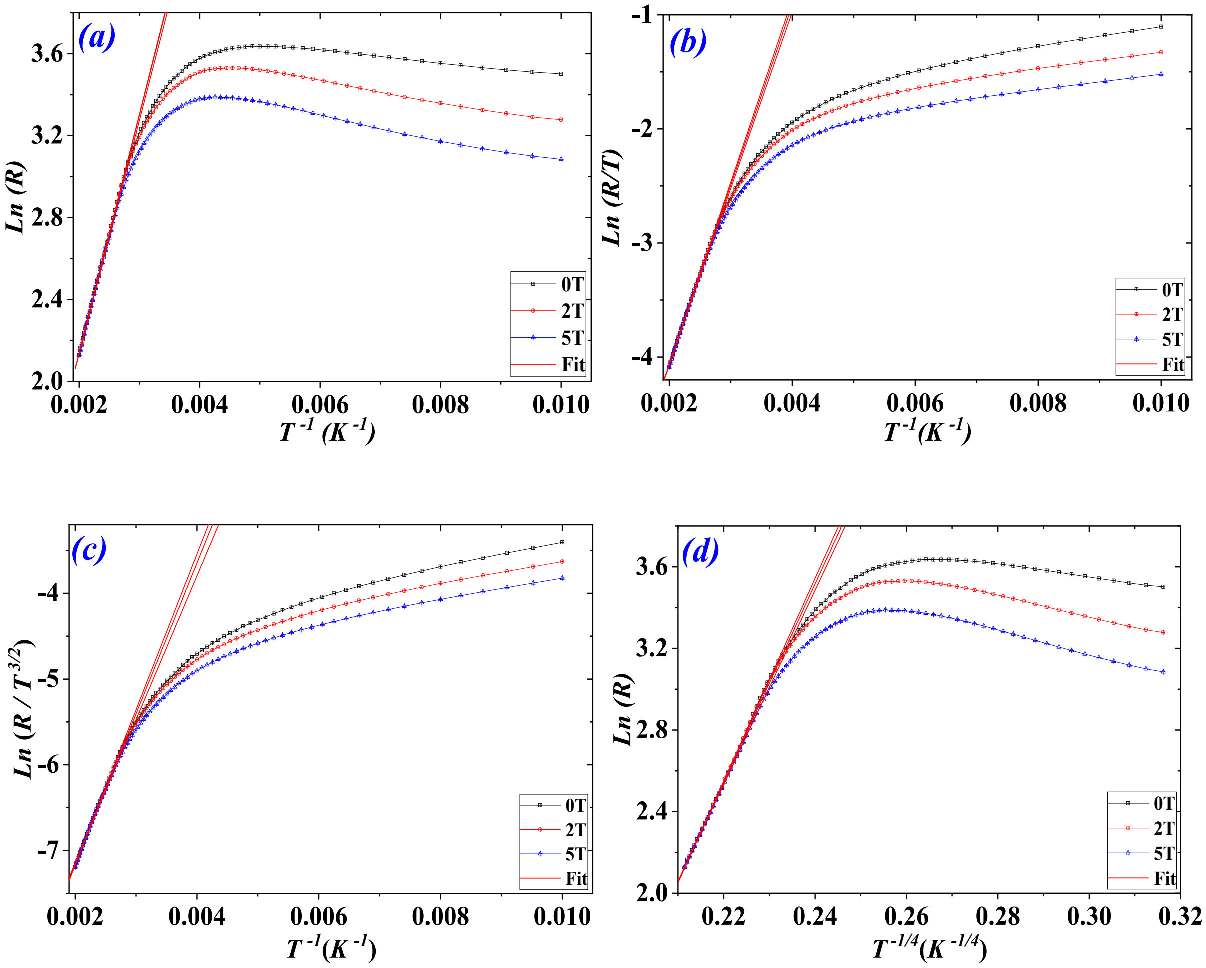

Fig. S4: Fit of the temperature dependence of resistance R(T), at high temperatures, under different applied magnetic fields of 0, 2 and 5 T, with the four transport models: **(a)** The (TAH), **(b)** the adiabatic (SPH), **(c)** the non-adiabatic (SPH) and **(d)** the (VRH).