

Quantum Dynamics in Quantum Mechanics and its Applications

E. A. Vashin, L. M. Kuznetsova

Moscow State University, Moscow, Russia

Abstract—R[LQJLVDPWHUPGHULYHGIURPGRFXPHQWVDQG KHQFH
FRQVLVWV RI FROOHFWLQJ LQIRUPDWLRQ RQ DQ RUJDQL]DWLRQ RU LQGLYLGXDO WKURXJK VRFLDO PHGLD ZHEVLWHV VHDUFK HQLQHV SDVVZRUG FUDFNLQJ
PHWKRGV VRFLDO HQLQHHULQJ WRROV DQG RWKHU VRXUFHV RI SXEOLFO\
GLVSOD\HG LQIRUPDWLRQ 7KH PDLQ SXUSRVH RI GR[LQJ DWWDFNV LV WR WKUHDWHQ HPEDUUDVV KDUDVV DQG KXPLOLDWH WKH RUJDQL]DWLRQ RU LQGLYLGXDO9DULRXVWRROVXVHGWRSHUIRUPGR [LQJ7RROVXFKDV 0DOWHJR YLVXDOL]H RUJDQL]DWLRQ\ V DUFKLWHFWXUH ZKLFK KHOSV LQ GHWHUPLQLQJZHDNOLQNVZLWKLQWKHRUJDQL]DWLRQ7KLVSDSHUGLVFXVVHV
OLPLDWLRQVRI0DOWHJR&KORULQH&(DQGVXJJHVW VPHDVXUHVVDVWR
KRZ RUJDQL]DWLRQV FDQ XVH WKHVH WRROV WR SURWHFW WKHPVHOYHV IURP GR[LQJDDWDFNV

Keywords—

\$GYDQFHG3HUVLVWHQW7KUHDW)2&\$26,173,,

.,1752'8&7,21

2;,1* LV WKH FROOHFWLQJ RI SHUVRQDO LQIRUPDWLRQ RI DQ

WRODXQFKDVRSKLVWFLDWHGDWDFNRQDWUJH WRUE\LQWHOOLJHGFH DJHQFLHV IRU LQYHVWLJDWRQ DQG VXUYHLOODQFH SXUSRVH 9DULRXV WRROV DQG DSSOLFWRQV LQFOXGLQJ RSHQVRXUFH VRIWZDUH DUH DYDLODEOHRQOLQHRIDFLOLWDWHWKHFROOHFWLQRILQIRUPDWLRQIURP WKHLQWHUQHWDQGRWKHUVRXUFHV

7S%/(

3DUXO.KDQQDLVDJUDGXDWHDQGUHVHDUFKDVVLVWDQW LQ,QIRUPDWLRQ6VWHPV 6HFXULW\0DQJHPHQWDW&RQFRUGLD8QLYHUVLW\RI(GPRQW RQSOEHUWD&DQDGD SKRQHHPDLOSNDQD#VWXGHQWFRQFRUGLDDEFD

'U3DYRO=DYDUVN\LVSRIHVVVRUDQGGULHFWRURIUHVHDU FKDW&RQFRUGLD 8QLYHUVLW\RI(GPRQWRSOEHUWD&DQDGDURU0DVWHURI,QI RUPDWLRQ6VWHP 6HFXULW\3URJUDP0,660+HLV&,663DQG&,60FHUWLILHGZLWK3+' LQ (OHFWULFDO (QJLQHULQJ IURP -DSDQSKRQH HPDLO SDYRO)DYDUVN#FRQFRUGLDDEFD
'DOH /LQGVNRJ LV DVVRFLDWH SURIHVVVRU DW &RQFRUGLD 8QLYHUVLW\ RI (GPRQWRSOEHUWD&DQDGDQ,QIRUPDWLRQ6VWHP6HFXUL W\0DQJHPHQW+H GLG KLV 3+' IURP <RUN 8QLYHUVLW\SKRQH HPDLO GDOHOLQGVNRJ#FRQFRUGLDDEFD
7DNLQJLQWRFRQVLGHUDWLRQWKHKXJHYROXPH RILQIRUPDWLRQ WREHFROOHFWHGDVLDQJOHWRROFDQQRWEHWUXV WHGWRFROOHFWWKH HQWLULQIRUPDWLRQDWRQHJR0RVVRIWKHVHWR ROVKDYHWREH XVHGVHSDUDWHO\WRFROOHFWWKHLQIRUPDWLRQ 2IWHQWKHILQGLQJV DQG UHVXOWV REWDLQHG XVLQJ GLIIHUHQW WRROV KDYH WR EH FRQVROLGDWHGWRJHWDEHWWHUXQGHUVWDQGL QJEHIRUHODXQFKLQJD GR[LQJDDWDFN7RROVOLNH0DOWHJRIDFLOLWDWH WKLVE\RUJDQL]LQJ 0DOWHJRLVDQRSHQVRXUFHWRROZKLFKJDWKHU VLQIRUPDWLRQ IURPRSHQVRXUFHV>@,WZRUNVRQ3WUDQVIRUPV'D QG3HQWLWLHV' ZKLFKDUHV\QRQ\PRXVWR3TXHULHV'DQG3REMHFWV '7UDQVIRUPV DUH FRGH VQLSSHVW JHQHUDOO\ ZULWWHQ LQ 3\WKRQ DQG FDQ EH PRGLLHG WR VXLW WKH QHGV RI D XVHU 2IWHQ WKH LQEXLOW WUDQVIRUPV RI 0DOWHJR IXQFWLRQ E\ VFDQQLQJ SRSXODURU OLPLWHGVRFLDOPHGLDVLWHV \$VVXFKQHZWUDQVIRUPVFDQEH FRGHG DQG LQWHJUDWHG ZLWKLQ WKH 0DOWHJR IUDPHZRUN WR LGHQWL\ FULWFLDO LQIRUPDWLRQ DYDLODEOH RQ RWKHU VLWHV)RU LQVWDQFH LI DQ RUJDQL]DWLRQ ZDQWV WR NQRZ ZKDW DOO FULWFLDO LQIRUPDWLRQ LV DYDLODEOH RQ D SDUWLFXODU ZHEVLWHVXFK DV *UDYDWDU ZKLFK LV QRW VFDQQH E\ LQEXLOW WUDQVIRUPV RI 0DOWHJRWKHURUJDQL]DWLRQFDQDGGURPRGL\WUD QVIRUPV RU TXHULHVIRUWKHZHEVLWH 7KH PDLQ FRQWULEXWLRQ RI WKLW SDSHU LV LGHQWLILFDWLRQ RI OLPLDWLRQV RI GR[LQJ WRROV VXFK DV 0DOWHJR WKURXJK H[SHULPHQWDO DQDO\VLV DQG SULPDULO\ IRFXV RQ PHDVXUHV E\ ZKLFKDWURUJDQL]DWLRQFDQSURWHFWLWVHOIURP

VRFLDO PHGLD ZHEVLWHV VXFk DV ± 6NASH ,QVWDJUDP <DKRR RU LQ IDFW <RX7XEH ,Q DGGLWLRQ LQEXLOW WUDQVIRUPV DYDLODEOH ZLWK 0DOWHJR &KORULQH &(IRU VFDQQQLQJURPSRSXODUVLWHVVFxKDV)DFHERRND UHOLPLWHGLQ WKHLU IXQFWLRQDOLW\ 7KHVH WUDQVIRUPV GR QRW SURYLGH WKH IROORZLQJHHDWXUHV

□ 5HWXUQLQJ)DFHERRNSURILOHE\HPDLO
□ 6HDUFKLQJ)DFHERRN SURILOH E\ D FRPELQDWLRQ RI DOLDV

SHUVRQQDPHFRPSDQ\QDPHFLW\FROOHJHDJHRUZHE VLWH

□ 5HWXUQLQJGDWDDERXWD)DFHERRNXVHUI URPWKHSDVVZRUG UHFRYHU\SDJH

□ ([WUDSRODWLQJ VHDUFK E\ FRPELQQLQJ UHVXOWV IURP RWKHU XVHIXOSRSXODUVLWHVVFxKDV*UDYDWDU

□ 6HDUFKLQJIRUVLPLQDU KDVKWDJVZLWKLQ)DFHERRN\VRFLDO QHWZRUN

SSDUWIURPWKLVDOWHJRWUDQVIRUPVGRQRWVVF DQRWKHUZHOO SRSXODU VLWHV VXFk DV ,QVWDJUDP 7UDQVIRUPV GR QRW UHWXUQ UHVXOWVEDVHGRQ,QVWDJUDPSURILOHQRUGRWKH \VHDUFKIRUWKH

XVHULQ,QVWDJUDPVRFLDOQHWZRUN\$OVRWKH\GR QRWVFDQIRUD SHUVRQRUHQLWLRQ*RRJOHSOXV

0DOWHJR &KORULQH &(UXQV WUDQVIRUPV RQ D VLQJOH HQWLW\HJ IDPH ,3 DGGUHVHV HWF ,W FDQQRW WDNH D

FRPELQDWLRQRHQWLWLVVVFxKDVQDPHQDQGORFD WLRQ,WGRHVQ\W FRPH ZLWK LQEXLOW WUDQVIRUPV ZKLFK DOORZ WUDQVODWLRQRU

FRQYHUVLRQ EHWZHHQ WZR ODQJXDJHV 0DOWHJR WUDQVIRUPV GR

QRWKHOSLQSUHGLFWLQJQRZYOQHUDEOHDZHEVL WHLVWRDWDFNVRU

YXOQHUDELOLWLHVVFxKDV+HDUWEOHHG7KHVH WUDQVIRUPVDOVRGR

QRW\HOGDQ\LQIRUPDWLRQRQWKHSULYDF\VHWWL QJVRIDSURILOH 7KH WUDQVIRUPV DOVR GRQ\W

WHOO DQ\ LQIRUPDWLRQ UHODWHG WR JHRORFDWLRQRIDQ\REMHFW

0DOWHJRGRHVQRWDOORZWKHXVHRIWUDQVIRUP VWRH[WUDFWDQ\SDUWLFXODU LQIRUPDWLRQ IURP D FRPSDQ\VR SURILOH 0DOWHJR GRHVQ\W DOORZ WR

VHDUFK ZLWKLQ WKH FRPSDQ\ WKH QDPH RI D SDUWLFXODU HPSOR\HH ,W GRHV QRW KDYH LQEXLOW WUDQVIRUPV WR H[WUDFW HPDLOV SKRQH QXPEHUV RU QDPHV RI SHUVRQV IURP D GRFXPHQWWH[W

7KLV SDSHU KLJKOLJKWV VRPH RI WKH OLPLDWLRQV RI GR[LQJ WRROVVFxKDV0DOWHJRDQGSURSRVHVQHZWUDQV IRUPVZKLFKFDQ KHOS RUJDQLJDWLRQV WR NQRZ

WKH XVHIXO RU FRQILGHQWLDO LQIRUPDWLRQ DYDLODEOH SXEOLFO\ \$V VXFk WKHVH VLPSOH EDVLF WUDQVIRUPV FDQ EH IXUWKHU LQWHJUDWHG LQWR D ODUJH IUDPHZRUN XVHGE\RUJDQLJDWLRQVDQGGFRQWULEXWHVVFHV VIXOO\LQDFKLHYLQJ WKH JRDOV RI SUHYHQWLQJ GR[LQJ DWDFNV)XUWKHU WHVWLQJ RI WKHVHWUDQVIRUPVPRGXOHVODGVWREHWWHUX QGHUVWDQGLQJRIKRZ WKHVH WRROV FDQ EH DFWXDOO\ XVHG E\ RUJDQLJDWLRQV WR SURWHFW WKHPDJLQVWGR[LQJDWDFNV

B. How Organizations Can Protect Themselves from Doxing Attacks

\$ VLQJOH WRRO GRHV QRW SURYLGH HQWLWUH LQIRUPDWLRQ ,Q DGGLWLRQ WRROV VXFk DV 0DOWHJR PDNHV XVH RI LQEXLOW

WUDQVIRUPVWRGR[LQIRUPDWLRQ(YHQLDKDFNWL YLVWZDQVWWR FXVWRPLJHWKHVHDUFKE\RUH[DPSOHDFRPELQDW

LRQRIQDPH DJH DQG ORFDWLRQ LW\VR QRW SRVVLEOH ZLWK LQEXLOW 0DOWHJR WUDQVIRUPV7KHUHIRUHLIDQRUJDQLJDWLRQGHYH

ORSVWUDQVIRUPV DVSHULWVRZQUHTXLUHPHQVWZKLFKDOORZLQFX VWRPLJLQJWKH

VHDUFLWZLOOEHDDEOHWRDZDUHLVWHOIRIWKHFU XFLDOLQIRUPDWLRQ DYDLODEOH SXEOLFO\ \$FWLRQV DQG SUHFDXWLRQV FDQ DOZDV EH

WDNHQWRSURWHFWWKLFRQILGHQWLDOQIRUPD WLRQLQIXWXUH 2WKHUFrxQWHUPHDVXUHVWRSUHYHQWGR[LQJD WDFNVLQFOXGH

Dox Yourself: 8VH WKH WRROV VXFk DV 0DOWHJR WR ILQG DV

PXFKSXEOLFO\DYDLODEOHLQIRUPDWLRQDVSRVVLE OHDQGWKHQWDNH

PHDVXUHVWRSURWHFWWKLQIRUPDWLRQLILWL VFRQILGHQWLDO7KH LQIRUPDWLRQ FROOHFWHG IURP GLIHHUHQV VRXUFHV VKRXOG EH H[DPLQHG

FDUHIXOO\ WR HVWDEOLVK 'FRQQHFWLRQV' RU 'OLQN' 'R[LQJ DWDFNV FDQ EH SUHYHQWHG E\ QRW GLVFORVLQJ SHUVRQDO

LQIRUPDWLRQRQFKDWURRPVDQGGPHVVDJHERDUGV)RULQVWDQFH GLVFORVXUHRI)DFHERRN,'PLJKWKHOSWKHKDFNWL

YLVWRSUHGFLW WKHV\SH,'LIWKHXVHUPDLQWDLQVWKHVDPH,'IRU ERWK7KH

VDPHLVDSSOLFDEOHZLWKS DVVZRUGV7KHUHIRUHL W\VDGYLVDEOHR

GHOHWH DQ\ VHQLWLYH LQIRUPDWLRQ OHDGLQJ WR VRPH RWKHU LQIRUPDWLRQ

\$WWLPHVWKHUFRPHVVLWXDWLRQZKHQDQRUJ DQLJDWLRQPLJKW ZDQW LWV HPSOR\HHV WR KDYH DFFHVV WR LPSRUWDQW LQIRUPDWLRQ DYDLODEOHRQZHEVLWHEXWQRWRWKHUV,QVXFkF

/%DOO*(ZDQ1&RXO*6RFLDOHQJLQHHULQJXVLQJRSHQVRXUFH
LQWHOOLJHQFHJDWKHULQJ'SYDLODEOHKWWWSVUHSRVLWRU\
DEHUWD\DFXN
MVSXLELWVWUHDPKDQGOH%DOOB
8QGHPULQLQJBSXWKRUBSGI"VHTXHQFH LV\$OORZHG\
/LQNV IRU GR[LQJ SHUVRQDO 26,17 SURILOLQJ IRRW SULQWLQJ
F'EHU VWDONLQJ' SYDLODEOH
KWWSSZZLURQJHHNFRPLSKS"SDJH VHFUXULW\
GR[LQJIRRWWSULQWLQJF'EHUVWDONLQJ
, 1 IRUULV *0LWLJDWLQJ WKH HIIHFVW RI GR[LQJ'
SYDLODEOH
KWWSSZZHFLHGXZSFRQWHQWXSORDGV,1RUULVB0LWLJDWL
QJ(IIH FWV2I'R[LQJSGI
6SOL7+HUL\DQWR*%DFNWUDFN\$VXXULQJ6HFXULWE\SHQHW
UDWLRQ WHVWLQJ' SYDLODEOH
KWWSSVERRNVJRRJOHFDERRNV"LG
6RGY.10%JZ& SJ 37 OSJ 37 GT
OLPLWDWLRQVRIPDOWHJ
R VRXUFH EO RWV 7OI,%E8P VLJ
(RVL);B*30E(=Y29&&K
L2J2Y RQHSDJH T OLPLWDWLRQVRIPDOWHJR I IDOVH
^XFLGHXV /DE IRU LQIRUPDWLRQ DERXW 'R[LQJ' SYDLODEOH
KWWSSOXFLGHXVWHFKEORJVSRRWFDGR[LQJKWPO
^LQJHUSULQWLQJ 2UJDQLJDWLRQV ZLWK &ROOHFWHG
\$UFKLYHV)2&\$'
SYDLODEOHKWWSSVZZZHOHYHQSDWKVFRPODEVWRROVIRFD
LQGH[KWPO
16FDQWRROS\$YDLODEOHKWWSSQVFDQK\SHUPDUWQHW
560DWKHZV*\$VWXG\RIGR[LQJLWVVFHXULW\PSOLFQDWLRQVD
QG
PLWLJDWLRQ VWUDWHJLHV IRU RUJDQLJDWLRQV'
SYDLODEOH
KWWSLQIRVHFFRQFRUGLDDEFDILOHV5RQH\B0DWKHZVSGI
00DU[*7KHH[WHQVLRQDQGFXVWRPL]DWLRQRI0DOWHJRGDWD
PLQLQJ
HQYLURQPHQW LQWR DQWLSKLVKLQJ V\WHP' SYDLODEOH
KWWSSZZFVUXDF]DUHVHDFKJPGRZQORDGVWKHVLVSGI
WUDQVIRUPV' SYDLODEOH
KWWSSZZSDWHUYDFRPZHEGRFXPHQWDWLRQ*XLGH7U
DQVIRUPVSGI